









***Great Lakes Reconnaissance Survey***  
***Water and Sediment Quality Monitoring Survey***  
***Harbours and Embayments***  
***Lake Superior and the Spanish River***

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## **FOREWORD**

The Environmental Monitoring and Reporting Branch monitors ambient water quality in the nearshore of the Great Lakes on a cyclical basis. In 1999 the focus of monitoring activities was on the Lake Superior nearshore. Environmental information was collected in the areas of Thunder Bay and Marathon Bay (Peninsula Harbour), Jackfish Bay, Nipigon Bay, the Pic River and the Spanish River, as part of the Great Lakes Nearshore Monitoring and Assessment Program. Although these data were not collected specifically for the Remedial Action Plan (RAP) program, this information can be used by the Lake Superior RAP teams as supplemental data to assess water and sediment quality improvements that may be related to remedial actions and determine if these Areas of Concern can be delisted.



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## EXECUTIVE SUMMARY

Surface water samples were collected in the spring, summer and fall of 1999 and sediment was collected during the summer survey in the areas of Thunder Bay and Marathon Bay (Peninsula Harbour), Jackfish Bay, Nipigon Bay, the Pic River and the Spanish River, as part of the Great Lakes Nearshore Monitoring and Assessment Program.

### *Nipigon Bay*

With few exceptions, water and sediment samples collected from Nipigon Bay did not suggest significant environmental impairments. There was some sediment contamination (i.e. dioxin-like PCBs (polychlorinated biphenyls), Hg, PAHs, PCBs, TOC), in the vicinity of the local pulp and paper mill and water pollution control plant (WPCP) but concentrations were not high enough to suspect impacts on the benthic community.

Concentrations of nutrients (with the exception of total phosphorus -TP), and bacteria in water were low. Total phosphorus concentrations were typically between 4 and 8  $\mu\text{g/L}$  at all stations sampled in the spring and summer survey with the exception of stations located 30 and 500 m respectively downstream of outfalls for the pulp and paper mill and Red Rock WPCP. Concentrations of TP ranged from 24 to 40  $\mu\text{g/L}$  in the spring at these two stations. Temperature and conductivity (measured by the Hydrolab), suggested the presence of a surface plume as well. Chloride concentrations were low at all stations ( $<3$  mg/L). Organic compounds in general and compounds associated with the pulp and paper industry in particular, were routinely below the method detection limit.

Water quality appears to have improved since the 1983 survey, which documented impairments to water and sediment due to effluent from the pulp and paper facility.

### *Jackfish Bay*

As with the data from Nipigon Bay, there were slightly elevated concentrations of some contaminants but sediment samples did not suggest significant environmental impairments. All the sediment data were extremely consistent with historical data, suggesting little change in sediment quality over time.

Impacts from the mill effluent on water quality throughout Moberly Bay and the northern and western portions of Jackfish Bay that were obvious in the 1981 and 1987/89 surveys (i.e. nutrients, metals and phenols greater than the Provincial Water Quality Objectives (PWQO), high suspended solids), were not evident in the 1999 survey. The installation of secondary treatment at the mill has likely contributed to the improvement in water quality throughout the bay. Although it should be noted that this survey only represents one day of sampling per season and the movement of the effluent plume is highly dependent on wind and current direction. However, notwithstanding the apparent improvement in water quality in Moberly Bay and Jackfish Bay, chloride concentrations and conductivity were clearly elevated at the mouth of Blackbird Creek (similar to historical data), as were concentrations of total inorganic nitrogen (TIN), total organic nitrogen (TON) and TP and suspended solids particularly in the spring and summer surveys. TP in the spring was 144  $\mu\text{g/L}$  at the mouth of the creek compared with concentrations in Moberly Bay and Jackfish Bay that were 16 and 4  $\mu\text{g/L}$  respectively. Also of note, were extremely high TP (440  $\mu\text{g/L}$ ) and ammonia/ammonium (1.16 mg/L) concentrations at this station in the summer. Dissolved oxygen was also lower at this station (5.5 mg/L) compared with all stations located further downstream (9 mg/L) and conductivity, measured using the Hydrolab, was as high as 1,351  $\mu\text{S/cm}$ . In general, water quality at the mouth of



Blackbird Creek was consistent with data collected in 1987/88 and does not appear to have improved substantially.

### ***Pic River***

Sediment quality in the Pic River and embayment were not enriched with metals or nutrients and all concentrations were less than the lowest effect level (LEL) with the exception of total kjeldahl nitrogen (TKN).

Water collected in the spring from the plume extending from the Pic was extremely turbid with suspended solid concentrations at 3,520 mg/L. *E. coli* and fecal streptococci counts were 280 and 720 counts/100mL, respectively. This was in contrast to data collected in the summer and fall. As well, nutrient concentrations were high compared with the other stations sampled in the area. TON concentrations were 2,398  $\mu\text{g/L}$  at a station located in the plume compared with concentrations that were less than 158  $\mu\text{g/L}$  at the remaining stations. TP was also high at 1220  $\mu\text{g/L}$  compared with concentrations that were between 4 and 12  $\mu\text{g/L}$ .

Although the surveys were representative of one day per season, the spring data in particular suggested that the Pic River has impaired water quality and could be a significant source of nutrients and bacteria.

### ***Spanish River***

Sediment samples collected from stations located downstream of the mouth of the Spanish River were contaminated with Cu, Fe, Mn and Ni. Concentrations of these metals in sediment at several stations were greater than the severe effect level (SEL). The highest concentrations were at two stations in the Whalesback Channel (station 401 and 209), but the impact from contaminant sources upstream in the Spanish River was evident throughout the area extending into Aird Bay and the McBean Channel. Sediment collected from one station was also contaminated with dioxins and furans. This pattern of sediment contamination was consistent with sediment surveys in the 1980's and 1990s and was attributed to the local mining and smelting industry which has been operating in the area since the 1930's (Spanish Harbour RAP Team 1993).

All metal concentrations in water were below the PWQO with the exception of Ni (PWQO: 25  $\mu\text{g/L}$ ), at the mouth of the Spanish River in the spring (27.6  $\mu\text{g/L}$  +/- 1.7  $\mu\text{g/L}$ ). Ni concentrations were consistently high at all stations in the survey area (21  $\mu\text{g/L}$ ) during the spring. In the summer and fall concentrations were lower but the highest concentration was always present at the station at the mouth of the river.

Nutrient concentrations (nitrogen and phosphorus) and suspended solids were consistent among the sampling stations and generally were low.

### ***Thunder Bay***

Results in 1999 were similar to previous studies in that the most degraded area was identified as the lower Kam River with a zone of impact that radiates out from its delta.

Previous surveys in 1983 and 1985/86 have identified the Kam River as a source of nutrients, metals and conventional parameters such as CI and biological oxygen demand (BOD) (Ontario Ministry of Environment et. al. 1991). The 1999 water quality data for TP, TIN and CI followed a similar pattern. TP was greater than the PWQO in samples associated with the Kam River



(range 48 to 72  $\mu\text{g/L}$ ). The source of inorganic nitrogen to Lake Superior is likely atmospheric, however, consistently for all three surveys, the highest concentration of inorganic nitrogen was detected at the mouth of the Kam River downstream of the sewage treatment plant (STP) suggesting the STP as a source of nitrate and ammonia/ammonium. The 1999 data for metals were also consistent with earlier studies whereby concentrations of metals in general were higher in the Kam River than at other stations sampled.

In contrast to earlier surveys where trichlorophenols, pentachlorophenol, resin acids and fatty acids and other products of the pulp and paper industry were detected in water collected from the Kam and Mission Rivers, in 1999 only reactive phenols were detected at trace concentrations.

Sediment TOC and loss on ignition (LOI) were extremely high outside the Provincial Papers filtration bed (station 465 - range: 180 mg/g to 380 mg/g and 360 to 710 mg/g, respectively). The field crew described the samples as "100% pulp from the mill discharge". The samples consisted of a grey and white fibrous paper material consistent with previous sampling surveys in the area (Ontario Ministry of Environment et al. 1991). The data suggested that the filtration bed was not adequately retaining the pulp discharged to the area. Mercury also exceeded the SEL in one replicate sample collected from this station (5.5  $\mu\text{g/g}$ ), but the remaining two replicates had lower concentrations (0.49 and 0.97  $\mu\text{g/g}$ ). The sediment within the filtration bed has a history of Hg contamination suggesting that the outlier is likely a real value and the areal extent of contamination highly variable. This site also had the highest concentrations of total Hg in water when compared with other sites in the survey (14 ng/L). As well, this station had the highest sediment concentrations of Pb, TKN, Cr, Cu and Zn.

### *Peninsula Harbour*

The historical discharge of Hg into Jellicoe Cove (from improperly treated wastewater, spills, leaks and vapour loss from the Fort James Marathon kraft pulp mill (formerly James River-Marathon Ltd.)) (Peninsula Harbour RAP Team 1991), was evident in the 1999 survey. Mercury concentrations in sediment detected at the two stations in Jellicoe Cove were similar to concentrations reported in a 1991 survey (Smith, 1992). Consistent with previous sediment surveys (Jardine and Simpson, 1990), PCB contamination was also detected in sediment from Jellicoe Cove and Beatty Cove, although concentrations were lower than in 1984. The PCB contamination is thought to have originated from the pulp and paper mill or the chlor-alkali plant (Smith, 1992). This was also likely the source of the polycyclic aromatic hydrocarbons (PAHs) and chlorinated benzenes detected in the sediment in 1999 at the same station in Jellicoe Cove.

Although there were significant water quality improvements in the vicinity of the mill's outfall since the 1970s due to improvements to the mill and the relocation of the outfall in 1983, PWQOs for some metals and organic compounds were exceeded in 1984/85. In contrast, in 1999 the PWQO was not exceeded for any parameters in samples collected upstream and downstream of the new outfall and concentrations of all parameters were similar (nutrients and metals) at the two stations. Parameters typically associated with the mill effluent such as resins and fatty acids, total reactive phenolics and chlorinated phenols were not detected in any water samples. As well, these parameters were not detected in Jellicoe Cove where the mill historically discharged its effluent. Chloride concentrations downstream of the mill were lower in 1999 than in 1984/85 (measured near the previous mill outfall) as were TP concentrations.

Bacterial contamination in the study area was low (or below the detection limit) as were concentrations of TP, ammonia, TKN and nitrate.



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## *GREAT LAKES RECONNAISSANCE SURVEYS - Harbour and Embayment Water and Sediment Quality Monitoring - Lake Superior and the Spanish River*

### **BACKGROUND**

The Environmental Monitoring and Reporting Branch monitors ambient water quality in the nearshore of the Great Lakes on a cyclical basis. In 1999 the focus of monitoring activities was on Lake Superior. Environmental information was collected in the areas of Thunder Bay and Marathon Bay (Peninsula Harbour), Jackfish Bay, Nipigon Bay, the Pic River and the Spanish River, as part of three sub-programs of the Great Lakes Nearshore Monitoring and Assessment Program (GLWQM).

The data collections were part of the **Great Lakes Reconnaissance Surveys (GLRS)**, a two part activity with the purpose of characterizing water quality conditions in the immediate nearshore, the zone most strongly and directly affected by land based activities. The two components of the work are:

(A) *Nearshore Mapping*

*A survey design suited to mapping spatial patterns is used to evaluate nutrient, bacteriological, physical and aesthetic features of water quality along selected ranges of shoreline throughout the Great Lakes, and*

(B) *Harbour Water Quality Monitoring*

*More extensive sampling at a limited number of key sites where water quality conditions are known to be impacted, or, have a potential for impact is used to assess the range of conditions in an area.*

*The objectives of the 1999 GLRS surveys were to:*

- (a) Determine general nearshore water quality conditions at harbours, embayments, and tributary mouths over a range of potentially degraded and background areas within the Lake Superior drainage basin,
- (b) Compare water and sediment quality among these areas, and
- (c) Flag locations and water/sediment quality parameters that exceed Provincial Water Quality Objectives and Provincial Sediment Quality Guidelines (PWQOs/PSQGs)

The third element of the GLWQM in which environmental information was collected in 1999 was the **Great Lakes Nearshore Index Station Network**. Data on water and sediment quality and the benthos were collected at various reference and index stations. The purpose of this activity was to provide information on how ambient water quality conditions were changing over time by periodically monitoring a suite of indicators at a small network of stations. A subset of the water quality data collected for the Index Stations are provided in Appendix 1.

Below is a summary of methods and results for the *Harbour Water Quality Monitoring* component of the GLRS surveys.



## METHODS

### Station Locations

Water and sediment were collected from five or six stations in each of the harbours or embayments. The 1999 data for each of the areas were compared with local Index stations also sampled in 1999. These stations were established in 1992 for the Great Lakes Nearshore Index Station Network. Figures 1 to 6 provide a map of the sampling stations from each survey area. All figures are provided at the end of the report.

### Field Methods

#### *Water*

Water samples were collected during three surveys (April, August, October) to assess seasonal variation.

Secchi depth, water temperature, field conductivity, field pH and field dissolved oxygen were measured at all stations using a Hydrolab. At stations less than 3 m in depth, parameters were measured at 0.5 m increments. If the depth was 3 m or greater, the station was profiled at 1 m increments. The profile data was not provided in this summary but is available on request.

Whole water (unfiltered) grab samples were collected at 1.5 m below surface at all sampling stations during each survey period (with the exception of the Index station where depth-integrated water samples were collected). If information from the profiling suggested that a plume existed shallower than 1.5 m, the water sample was collected from within the plume. At shallow stations (less than 3 m) the samples were collected at mid depth unless a shallow plume had been identified. Water samples were collected using a March Model 5C MD submersible pump with Teflon® fittings. The tubing was cleaned with acetone every day. The sampling line was rinsed with sample water at each station prior to sample collection for 5 minutes. Water samples collected for bacterial analysis were collected directly into a sample bottle held at 1 m below the surface using a sampling pole. Metal samples were acidified according to the Laboratory Service Branch methods manual, and mercury samples were collected and acidified as per instructions provided below. Standard sample containers (PET, 8C) were used unless otherwise indicated (e.g. low level Hg analysis). Except for those bottles that contained preservatives or had been pre-cleaned or required special instructions (e.g. Hg), all sample containers were rinsed twice with sample water before filling the container.

Depth-integrated water samples were collected from the Index stations by lowering, at a steady rate, a collection device consisting of two, 1 litre glass bottles fitted in a lowering frame.

Laboratory analysis of water samples included the following parameters: chloride, ammonia/ammonium, nitrate/nitrite, total kjeldahl nitrogen (TKN), total phosphorus (TP), suspended solids, arsenic, mercury (Dorset low level analysis), metals (Al, As, Ba, Be, Cd, Co, Cr, Cu, Fe, Hg, Mn, Mo, Ni, Pb, Sr, Ti, Wu, Zn) and bacteria, as well as, resin and fatty acids, chlorinated phenols, total phenols and acid, base, neutrals. Conductivity was analysed at selected stations to serve as a comparison with field measurements. Water collected from the Index stations was submitted for a subset of the above listed parameters.



### *Low Level Mercury Analysis*

Single samples were collected from each station in the spring, summer and fall. The spring samples were collected using the March Model 5C MD submersible pump with Teflon® fittings as described above. The “field blanks” from the spring data (obtained by pouring distilled water through the collection system for 5 minutes and then collecting a sample which was submitted for all analytical requests), indicated that the Hg samples were being contaminated, in part, from the sampling line (Appendix 2). The contamination of the field blanks was also due to the double distilled water passed through the sample line. This was concluded based on the data from the spring “travel blanks” (obtained by filling the sample bottles with double distilled water from the Rexdale laboratory and transporting them to the field and back.). Accordingly, the spring data should be interpreted with caution although the results are consistent with the data collected in the summer and fall.

Our spring “handling blank” indicated that contamination due to sample handling was minimal (0.9 ng/L). Handling blanks consisted of a sample bottle filled with distilled water from the Dorset lab (where the samples were analysed for Hg), opened in the field for about 10 seconds or the length of routine sampling time and acidified as per a normal sample. The acid used to acidify the samples was also analysed for Hg and the result showed minimal contamination as well (0.67 ng/L).

Based on the results from the spring, our sample collection procedure was modified for the summer and fall surveys. Water samples were collected directly into the sample bottle using a pole from a depth of 1.5m. The “handling blanks” for the summer and fall collection provided an indication of contamination from sample processing. The “travel blanks” for the remainder of the survey confirm the contamination of the Rexdale laboratory double distilled water. This water did not come in contact with the samples.

Good quality, powder free latex or vinyl gloves were worn during the sample collection and preparations. Gloves were changed frequently throughout the day. Water samples for low level mercury analysis were collected in preconditioned, pyrex, 250mL sample bottles. The bottles were not un-bagged until sampling, rinsed at least 3 times with sample water (using the pole), re-bagged immediately after acidification (or prior to acidification if the samples were to be acidified at the end of the day), and kept in a cooler or refrigerator in the dark. Bagged samples were placed in a second larger bag. Labels were on the outside of the bags to avoid label contamination. Sample bags were closed tightly and the second larger bag was carefully placed in the cooler to avoid melting ice from entering the bags.

For acidification, 1 mL of clean, good quality concentrated HCl was added to each sample, using a clean pipette tip, discarding tip if it became contaminated with sample water from splashing.

### *Sediment*

Sediment was collected in August. At each station three replicate grab samples (top 3 cm) were collected using a Shipek grab sampler. If samples were observed in the field to be high in percent sand, only a single or duplicate sample was collected. Sediment was submitted for analysis for the following parameters: particle size groups, loss on ignition (LOI), total organic carbon (TOC), total phosphorus, total kjeldahl nitrogen, arsenic, mercury, ICP metals, total PCBs (polychlorinated biphenyls), organochlorine pesticides and chlorinated benzenes, polycyclic aromatic hydrocarbons (PAHs), total petroleum hydrocarbons and dioxins/furans (one sample per area only). Sediment collected from the Index stations were submitted for a subset of the above listed parameters.



The top 3 cm was removed from the sampler, homogenized, and distributed into the appropriate containers using stainless steel and Pyrex implements rinsed with distilled water and hexane between samples.

### *Quality Assurance/Quality Control*

#### *Water*

One field blank and 1 split sample was submitted for all water quality parameters per sampling period per sampling area. The field blank provided information on field and sample container effects. The split sample provided information on sample handling and analytical reproducibility. The field blank was obtained by pouring distilled water through the collection system for 5 minutes and then collecting a sample, which was submitted for all analytical requests (except bacteria).

Distilled water travel blanks were obtained by filling the required bottles for all analytical requests (except bacteria) and transporting them to the field and back. All blank data are provided in Appendix 2. Data provided in this report were not “blank corrected”.

#### *Sediment*

For sediment, 1 split sample was submitted for all sediment quality parameters per sampling area. This split sample provided information on sample handling/preservation and transport effects in combination with analytical reproducibility.

### *Analytical Methods*

All water and sediment samples were analysed at the MOE Rexdale laboratory with the exception of the low-level Hg analysis that was provided by the MOE Dorset Laboratory. All laboratory analytical procedures for contaminants in water and sediment followed the methodology outlined in the Handbook of Analytical Methods for Environmental Samples (MOE 1983).

For water analysis, procedural updates are provided in MOEE (1995d, 1995f to 1995i and 1997a to 1997c.). For sediment analysis, procedural updates for metals, nutrients, particle size, LOI and TOC are provided in MOE 1989a & b and MOEE 1995a, b & e, 1997d. Procedural updates for total PCBs, (MOEE 1996), organochlorine pesticides and chlorinated benzenes, polycyclic aromatic hydrocarbons (PAHs), total petroleum hydrocarbons and dioxins/furans are provided in MOEE (1994a & b and 1995c).

### *Data Interpretation and Analysis*

Since water samples were collected at a single point in time within a season (spring, summer and fall), the data are an indication of the water quality at the time of sampling only. Lake Superior has a large influence on the nearshore and tributaries, hence changes in the concentration of various parameters in the nearshore area can be significant over a short time due to variations in Lake Superior currents, tributary flow rates and local weather patterns (e.g. precipitation events).

Concentrations of contaminants in water and sediment samples were compared with the Provincial Water Quality Objectives (PWQO) (MOEE 1994) and the Ontario Sediment Quality Guidelines (PSQG) (Persaud et al. 1992). As well, sediment contaminant data were compared



with mean background contaminant concentrations for the Great Lakes basin (pre-colonial horizon) (Persaud et al. 1992) and for Lake Superior depositional zones (Mudroch et al. 1988).

For bacteria, the Ontario Ministry of Health and Long Term Care has established a guideline for recreational water quality which is 100 *E. coli* per 100 mL sample based on the geometric mean of the level of *E. coli* averaged over a minimum of five samples collected within one month (MOEE 1994). The data from the Harbour Water Quality Surveys were compared with this guideline. However, note that conclusions are based on three rather than five sampling events over seven months and since samples were not collected according to MOE Beach Monitoring Protocol these data can not be used to infer the presence or absence of a health risk.

TIN is defined as total inorganic nitrogen (nitrate plus nitrite plus ammonia/ammonium) and TON is total organic nitrogen (total kjeldahl minus ammonia/ammonium).

Trace elements tend to accumulate and bind to the clay/silt sediment fraction represented by particle sizes of less than 63  $\mu\text{m}$  (Forstner and Wittmann 1983; Krumgalz et al. 1992). Accordingly, it is necessary to adjust trace element concentrations for the different particle size distributions at the various sampling stations in order to compare contaminant concentrations between stations if the effect of depositional environments are to be diminished and trace metal contaminant sources are to be inferred. The approach taken in this summary was to normalize the anthropogenic trace metal results to a "conservative" element such as aluminum (i.e. an element that is not believed to be locally enriched). The ratio of the other metals to aluminum should remain constant across a gradient of particle sizes unless there is an enrichment of the other metal (Forstner 1990).

## SUMMARY OF RESULTS

### Water Quality

Water quality data are provided in Tables 1 and 2. All tables are appended at the back of the report.

Suspended solid concentrations tended to be low at most stations sampled at all survey areas ( $< 4$  mg/L) with the exception of samples collected from tributary mouths (i.e. mouth of the Spanish River: 3-11.5 mg/L; Blackbird Creek: 3-9 mg/L; Pic River: 14 mg/L) and samples collected close to outfalls (e.g. Red Rock WPCP and Norampac pulp and paper mill: 6 mg/L). As well, secchi depth measurements improved with increased distance from suspected contaminant sources and tributary mouths.

Secchi depth was low (spring range: 0.4 to 0.8 m) at stations associated with the Kam River and Mission and McKellar River in Thunder Bay reflecting the high suspended solids concentrations at these stations (spring range: 6.5 to 14.5 mg/L). In the spring and fall suspended solid concentrations were high in the Kam and Mission Rivers with concentrations decreasing towards the river mouths and along a transect extending from the Mission River (including the Mission Bay Disposal Area) (Table 1 & Figure 7). Based on suspended solids data, the water quality of the Kam River impacts the Mission River to a greater extent than the McKellar River. This pattern was reflected in all water quality parameters.



### ***Bacteriological Analysis***

With the exception of the Pic River and Thunder Bay, there was no evidence of bacterial contamination in any of the water samples collected. Bacteria counts were high in one sample (*E. coli* and fecal streptococci counts were 280 and 720 counts/100 mL, respectively), collected from the plume that extended from the mouth of the Pic River. Combined with high phosphorus, nitrogen and suspended solid concentrations, the data suggested that the Pic River had extremely poor water quality on that particular day of sampling.

In Thunder Bay, bacterial counts greater than 100 *E. coli* per 100 mL, were detected only in samples collected from the Kam and Mission Rivers in the spring and from one sample near the Mission Bay Disposal area in the summer. The highest counts of fecal streptococci were also present in samples collected from the Kam and Mission Rivers. The Kam River appears to be the source of the contamination.

### ***Total Phosphorus***

Overall, the highest total phosphorus concentration was present in the spring water sample collected from the Pic River (1,220  $\mu\text{g/L}$ ). In general, concentrations were consistently high at the mouth of Blackbird Creek downstream of the pulp and paper mill in Jackfish Bay and downstream of the mill and WPCP outfall in Nipigon Bay. Concentrations were greater than the interim Provincial Water Quality Objective (20  $\mu\text{g/L}$ ) at these stations. Typically, concentrations decreased with increasing distance from these suspected sources.

In Thunder Bay the highest total phosphorus concentrations were present in water samples collected from the Kam and Mission River (range over three surveys: 48 to 72  $\mu\text{g/L}$ ) suggesting the Kam River as a source of nutrients (Table 1; Figure 8). The Welcome Island Index station and stations near the old Abitibi outfall had low phosphorus concentrations (range: 4 to 8  $\mu\text{g/L}$ ).

### ***Nitrogen***

Total organic nitrogen concentrations tended to be greater at the mouths of tributaries and near outfalls than at the stations farther offshore. With the exception of Thunder Bay (TON: 664  $\mu\text{g/L}$ ), the Pic River (TON: 2,398  $\mu\text{g/L}$ ) and Blackbird Creek (TON: 1,880  $\mu\text{g/L}$ ), TON concentrations throughout the surveys were less than 500  $\mu\text{g/L}$  with most samples less than 300  $\mu\text{g/L}$ . Concentrations in Peninsula Harbour were typically less than 100  $\mu\text{g/L}$ . However, the opposite was true for inorganic nitrogen. TIN concentrations tended to be higher at the stations located farther offshore and reflected the atmospheric contribution of nitrogen to Lake Superior. Concentrations of TIN were typically less than 350  $\mu\text{g/L}$  throughout the survey areas with the exception of Jackfish Bay (range from 312 to 1,645  $\mu\text{g/L}$ ). The lowest concentrations were present in Nipigon Bay (range from 72 to 262  $\mu\text{g/L}$ ).

Given the industrial and urban development in the area, it is not surprising that the Kam River is a source of organic material to the bay and has higher concentrations of TON than Lake Superior. TIN concentrations at the upstream station in the Kam (station 802) and at the mouth of the Mission River (station 176) were similar to each other in the spring and fall and consistently lower than TIN concentrations at the remaining stations in Thunder Bay (Figure 9). Since the source of inorganic nitrogen to Lake Superior is likely atmospheric, the smaller area of the Kam River compared with the lake is likely responsible for the lower TIN concentrations in the rivers. However, consistently, for all three surveys, the highest concentration of inorganic nitrogen was detected at the mouth of the Kam River downstream of the STP suggesting the STP as a source of nitrate and ammonia/ammonium.



### *Chloride*

Chloride concentrations in general were highest throughout the Spanish River survey area (range 5 to 20 mg/L) and in particular at the mouth of Blackbird Creek in Jackfish Bay (maximum concentration 166 mg/L). The remaining stations in the Jackfish Bay survey area and all stations in Nipigon Bay and the Pic River area had similar concentrations which tended to be less than 4 mg/L.

In Thunder Bay results for chloride were similar to patterns for suspended solids, TP and TON concentrations and bacteria. In general, the Mission and McKellar River showed enrichment of Cl due to loadings from the Kam River. Concentrations in all three rivers ranged from 6.8 to 10.6 mg/L in the spring compared with 1.2 mg/L at the Welcome Island Index station. The lowest Cl concentrations were present in the summer but the gradient between the Kam, Mission, McKellar River and the Welcome Island Index station was maintained. Although the Kam is considered a source of Cl to the bay, the concentrations were at least two times lower than concentrations detected in tributaries to Lake Erie and Lake Ontario (Richman, 2001; MOE unpublished data).

### *Trace Metals*

Although chromium and aluminum concentrations exceeded the PWQO (Cr VI-1  $\mu\text{g/L}$ , Al-75  $\mu\text{g/L}$ ) at several stations in the survey this data must be reviewed with several caveats in mind.

The observed high concentrations of Al were related to the high suspended solids concentrations in the water samples since samples analysed for this survey were not filtered. However, the PWQO for aluminum (75  $\mu\text{g/L}$ ) is based on total Al measured in a clay-free sample making comparisons with the PWQO difficult.

Comparisons of the Cr data with the PWQOs for Cr VI should be made with the caveat that it is unknown whether the concentrations provided for total Cr represent Cr VI or Cr III or some proportion of the two ionic states. The concentrations were also at trace levels. Concentrations of Cr exceeded the guideline for Cr VI at most stations in the surveys. However, the highest concentrations were typically associated with Nipigon Bay, the Kam and Mission Rivers in Thunder Bay.

In general, the highest concentration of most metals (Cu, Mn, Pb, Ni, and Zn) in water, although not greater than the PWQOs, were present in samples collected from the tributaries in Thunder Bay compared with the Welcome Island Index station and stations near the old Abitibi outfall and Provincial Papers. This data suggested that the Kam River is a source of these metals although the higher concentrations can also be related, in some cases, to the suspended solid concentrations.

Nickel concentrations exceeded the PQWO (25  $\mu\text{g/L}$ ) in one sample collected from the Spanish River in the spring. Nickel concentrations approached the PWQO at the remaining stations in the survey area during the spring survey. However, concentrations in the Spanish River survey area decreased in the summer and fall.

### *Mercury*

With only a few exceptions at each survey area, Hg concentrations were low. There was no relationship between the suspended solid concentrations and Hg concentrations ( $r = 0.0044$ ) and there was no apparent seasonal pattern. In general, the highest concentrations were detected in



samples collected from the Spanish River and the Pic River in the summer. For the Spanish River, the high concentrations were present in samples collected from the Whalesback Channel (6-11 ng/L), while the remaining samples in the area over the three surveys ranged from 0.5-3.45 ng/L.

In the Pic River the highest concentrations in the spring and summer ranged from 6 to 10.6 ng/L while remaining concentrations ranged from 0.15 to 3.3 ng/L. The lowest concentrations in general were present in the fall survey. High Hg was associated with the plume extending from the river.

Concentrations in Nipigon Bay ranged from 0.3 to 2.55 ng/L for all three surveys with the exception of two samples collected in the summer that were 4.9 and 11.1 ng/L collected from stations downstream of the mill and WPCP. However, the sample collected from the station closest to these two facilities (station 459) had lower Hg concentrations (2.1 and 2.55 ng/L) confounding the notion that they were the source of the Hg.

The highest Hg concentrations in general in the Jackfish Bay area were present at the mouth of Blackbird Creek (5.7 ng/L). Hg concentrations at the remaining stations in Jackfish Bay did not appear to follow any consistent pattern and ranged from 0.7 to 2.85 ng/L. Terrance Bay, which served as a reference area for Jackfish Bay, had Hg concentrations that ranged from 0.45 to 1.3 ng/L.

Mercury concentrations in water collected from Thunder Bay followed the same pattern as the other metals (i.e the highest concentrations were associated with the Kam River and Mission River). Mercury concentrations decreased towards the mouth of the Kam and in the McKellar River and with increasing distance along the transect from the Mission River. This pattern was consistent for all three surveys. Although the pattern may be related to the suspended solid concentrations, the correlation between Hg and suspended solids was not as strong in the summer ( $r=0.72$ ) or fall ( $r=0.47$ ) compared with the spring ( $r=0.92$ ).

High Hg concentrations were also present in samples collected outside the Provincial Papers filtration bed. This was consistent for all three surveys suggesting a source of Hg within the filtration bed. This data was also consistent with the sediment data which showed high concentrations of Hg. The site has been historically contaminated with mercury and data were consistent with data collected in a previous study in 1997 and 1998 prepared by Beak International INC (Beak 1999).

Mercury concentrations in water collected from Peninsula Harbour were low despite the high concentrations of Hg in the sediment. Concentrations among the stations were similar and lower in Peninsula Harbour than Thunder Bay.

### ***Resins and Fatty Acids, Phenols and Chlorinated Phenols***

With the exception of trace concentrations ( $<0.8 \mu\text{g/L}$ ) of unfiltered reactive phenolics in a few samples collected from the mouth of Blackbird Creek, Moberly Bay, Thunder Bay and Nipigon Bay, resins and fatty acids, chlorinated phenols and acid, base, neutrals were not detected in any water samples collected within the survey areas. Trace concentrations were below the PWQO for phenols which is  $1 \mu\text{g/L}$ . Water samples were not submitted for the acid, base, neutrals in the fall survey.



### *Sediment Quality*

Sediment quality data are provided in Tables 3 to 7.

### *Sediment Physical Qualities and Metal Concentrations*

Sediment samples collected from the study areas had variable physical characteristics, which can influence contaminant concentrations. Generally, soft sediment was targeted for collection. However, there were stations sampled that had sediment particularly high in sand content (e.g. mouth of the Spanish River, Blackbird Creek (Jackfish Bay), Kam River mouth, downstream of the STP in Peninsula Harbour, and most samples collected from the Pic River (Table 3). This physical difference will affect the sediment metal, TOC and loss on ignition concentrations, which tend to be positively correlated with particle size. Accordingly, sediment metal data were normalized to Al to account for the particle size differences and facilitate the comparison of metal and nutrient data among stations as an indication of proximity to source. The ratio of the other metals to aluminum should remain constant across a gradient of particle sizes unless there is an enrichment of the other metal (Forstner 1990). The Al normalized data can be provided on request.

With the exception of TOC in Nipigon Bay and Thunder Bay, As, Fe, Cu, Mn and Ni in the Spanish River survey area, and Fe and Hg in Thunder Bay and Peninsula Harbour, contaminant concentrations were all less than the PSQG Severe Effect Level (SEL) suggesting limited biological impacts due to trace metal contamination at the stations in the survey. The area downstream of the Spanish River (Whalesback Channel) does show significant metal contamination as does the area near Provincial Papers in Thunder Bay and Jellico Cove (Peninsula Harbour).

Typically, Cr, Cu, Fe, Mn, Ni, TKN and TP concentrations in sediment in all study areas (with the exception of the Pic River), were greater than the Lowest Effect Level (LEL) at most stations (Table 3). The highest concentrations in general were present in the Spanish River area. Sediment concentrations for most metals were similar in Jackfish Bay and Nipigon Bay. However, when metal concentrations were normalized to Al to adjust for differences in particle size, there appeared to be some enrichment of Cd, Cr, Cu and Zn at the Moberly Bay station (station 702-Jackfish Bay). With the exception of TKN, sediment collected from the Pic River survey area did not exceed any SQG. This was likely due to the high sand content of the samples (>84%). When the sediment metal data was normalized to Al, the ratios calculated for stations in the Pic River were similar to ratios calculated for Jackfish and Nipigon Bay. Cadmium concentrations were greater than the LEL only in sediment collected from Jackfish Bay and the Spanish River area. While Hg and Pb concentrations were only higher than the LEL at one station in Nipigon Bay and in the Spanish River survey area, respectively.

In some cases, exceedances of the LELs may be typical for the Lake Superior basin and reflect the regional geology rather than due to industrial discharges. The Jackfish Bay Stage 1 RAP Report (1991) suggested that only Hg, Zn, TKN and TOC were associated with the mill effluent and elevation of other metals were likely associated with the natural geology. Accordingly, the contaminant data was compared with background values for the whole Great Lakes basin (pre-colonial sediment horizon) (Persaud et al. 1992), and with values specific to Lake Superior (Mudroch et al. 1988) (Table 3). However, although the data collected by Mudroch et al. was specific to Lake Superior, it was only based on one sample. This comparison showed that with few exceptions (e.g. Spanish River survey area), most contaminant concentrations were either below or within the background range provided. As and Ni concentrations in the Kam River were greater than the Persaud et al. background values as were Cr, Cu and Zn concentrations.



Mercury concentrations at the Thunder Bay Index station also exceeded the Persaud et al. background concentration as well as concentrations of Ni and Pb.

TOC and LOI were extremely high outside the Provincial Papers filtration bed (station 465 - range: 180 mg/g to 380 mg/g and 360 to 710 mg/g respectively). Field crew described the samples as “100% pulp from the mill discharge”. The samples consisted of a grey and white fibrous paper material consistent with previous sampling surveys in the area (Ontario Ministry of Environment et al. 1991). The data suggested that the filtration bed is not adequately retaining the pulp discharged to the area. Further study by Beak in 1997 and 1998 delineated the spatial extent of the elevated TOC and Hg concentrations (Beak 1999). However, impacts on the local benthic community structure should be investigated. Mercury also exceeded the SEL in one replicate sample collected from this station (5.5  $\mu\text{g/g}$ ), but the remaining two replicates had lower concentrations (0.49 and 0.97  $\mu\text{g/g}$ ). The sediment within the filtration bed has a history of Hg contamination suggesting that the outlier is likely a real value and the areal extent of contamination highly variable. This station also had the highest concentrations of Pb, TKN, Cr, Cu and Zn. With the exception of “sediment” (pulp) collected from outside the filtration bed and Welcome Island, Hg concentrations were all less than the LEL in the Thunder Bay area. Mean Fe concentrations were greater than the SEL at two stations in Thunder Bay; in the Kam River where it joins with the Mission River (station 802) and at the Welcome Island Index station.

Of note were the two stations in Jellicoe Cove (Peninsula Harbour), where Hg concentrations ranged from 8.4 to 21  $\mu\text{g/g}$  (at station 276 near the wharf) and from 3 to 4  $\mu\text{g/g}$  at station 279. These results were not surprising given the history of Hg discharged from the former chlor-alkali plant (closed 1977). Mercury has historically been a contaminant of concern in Jellicoe Cove (Peninsula Harbour RAP Team, 1991; 1997). Although concentrations of Hg did not exceed the SEL at the Hawkins Island station, concentrations were still enriched relative to the Index station in Beatty Cove and the stations SW of the Peninsula (Table 3). When the data were normalized to Al, the Hg concentration in sediment collected from station 276 in Jellicoe Cove was at least 35 times greater than the concentration in sediment collected from Beatty Cove. The sediment collected from Hawkins Island was twice as high as the Beatty Cove sediment. This pattern of sediment Hg contamination was consistent with data collected in 1973 and 1984 (Peninsular Harbour RAP Team 1991).

#### ***Organochlorine Pesticides, Chlorinated Benzenes and Polychlorinated biphenyl (PCBs)***

Chlorinated benzenes were not detected in sediment samples collected from any of the study areas with the exception of trace concentrations of hexachlorobenzene in sediment collected outside the Provincial Papers' filtration bed and in samples collected from Peninsula Harbour. In Peninsula Harbour, trace concentrations of hexachlorobenzene were detected in sediment collected from station 468 on the northeast side of Hawkins Island and at the Index station in Beatty Cove (as well as pentachlorobenzene at station 468). Detectable concentrations of several chlorinated benzenes were present in sediment collected from Jellicoe Cove, near the wharf, at station 276; 135-trichlorobenzene, 1235-tetrachlorobenzene, hexachlorobenzene and pentachlorobenzene suggesting the possibility of a local source (Table 4).

Organochlorinated compounds were detected in only a few samples (Table 5). Trace concentrations of  $\beta$ -BHC,  $\alpha$ -chlordane, heptachlor, oxychlordane, p'p-DDE and p'p-DDT, were detected consistently at one or two stations in the Whalesback Channel (downstream of the mouth of the Spanish River), and in Nipigon Bay downstream of the mill and WPCP outfalls (station 459) and at several stations in Thunder Bay. Trace concentrations of total PCBs were also detected at two stations downstream of the mill and WPCP in Nipigon Bay (range 80 to 200 ng/g) suggesting a local source. Concentrations were greater than the PSQG LEL, which has



been set at 70 ng/g. Kirby (1986), detected PCBs in the mill effluent and receiving water in 1983.

The highest concentrations of PCBs in Thunder Bay were detected in sediment from the Welcome Island Index station (range: 40 ng/g to 100 ng/g) (Table 5). PCBs were detected only sporadically at the remaining stations.

In Peninsula Harbour the highest PCB concentrations were detected at the Index station in Beatty Cove (range: 160 to 180 ng/g) and near the wharf in Jellicoe Cove (station 276) (range: 180 to 240 ng/g). PCBs were also detected at station 468 (Hawkins Island) but at lower concentrations. When the data were normalized to TOC, concentrations were similar at all three stations. PCBs were not detected at the remaining stations in Marathon likely because of the high sand content of the samples. More detailed sampling could identify if the areal extent of the PCB contamination is consistent with the Hg contamination thereby suggesting a common source.

### *Polycyclic Aromatic Hydrocarbons (PAHs)*

PAHs do not appear to be a significant biological concern at any of the stations sampled in this survey. Sediment collected from all stations, with the exception of the Whalesback Channel, had concentrations of PAHs below the LEL (2 µg/g) (Table 6). However, only one sample collected from the station in the Whalesback Channel had a total PAH concentration of 3,960 ng/g. The remaining samples had concentrations that ranged from below the detection limit to only 120 ng/g suggesting that the other sample should be interpreted with caution.

The most frequently detected compounds were benzo(b)fluoranthene, fluoranthene, phenanthrene and pyrene. PAHs were detected in all areas of study with the exception of the Pic River. Concentrations were generally low (trace) for most compounds. The highest mean concentration of total PAH was present in sediment collected from station 459 in Nipigon Bay (mean 640 ng/g, SD 124.9 ng/g) and at one station in the Jackfish Bay area downstream of Backbird Creek in Moberly Bay (mean 1,795 ng/g, SD 125.8 ng/g).

Consistent with the chlorinated benzene data, the highest concentrations of PAHs were present at the Jellicoe Cove site (station 276) where detectable concentrations of several compounds were present suggesting a local source (anthracene, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, chrysene, fluoranthene, naphthalene, pyrene and phenanthrene) (Table 6). Concentrations at the remaining stations were low or non-detectable. When the PAH concentrations were normalized to TOC, the data still identified station 276 as being enriched with PAHs.

### *Polychlorinated-p-dibenzodioxins and Polychlorinated dibenzofurans*

Sediment was collected from only one or two stations from each survey area for dioxins and furans analysis. The highest concentrations were present in sediment collected from the Spanish River Index station (Table 7). Toxicity Equivalency Factors (TEFs) have been used as a measure to express the toxicity of different dioxins and furans on a common basis. TEFs were assigned to individual dioxins and furans on the basis of how toxic they were in comparison with the toxicity of 2,3,7,8-tetrachlorodibenzo-p-dioxin (T4CDD), which was assigned the value of 1.0. When concentrations of individual isomers are converted to toxicity equivalents of 2,3,7,8-T4CDD they are then summed to yield a total toxic equivalents (TEQ). The World Health Organization TEFs for the protection of humans and mammals from August 1997 were used for the calculations (van den Berg et al. 1998). The calculated TEQs can be compared with sediment quality guidelines. Ontario does not have a Sediment Quality Guideline (SQG) for dioxins and



furans at present, however, the interim SQG for the No Effect Level for 2,3,7,8-T4CDD has been set at 25.7 pg/g.

The TEQs at the Spanish River Index station (49 and 51 pg/g) suggested that the sediment is contaminated with dioxins and furans, particularly when compared with the interim provincial SQG and TEQs for the remaining stations which were less than 10.5 pg/g. When values were normalized for sediment TOC concentrations, these two samples still remained the highest compared with samples collected from the remaining stations. The likely source of the dioxins and furans was a pulp and paper mill located upstream in the Spanish River. The highest concentrations of 2,3,7,8 tetrachlorodibenzo-p-dioxin (the most toxic form of dioxin) and 2,3,7,8 tetrachlorodibenzo furan were also present in sediment collected from this station.

Dioxins and furans were not detected in sediment collected from the Pic River or Blackbird Creek (Jackfish Bay) although low concentrations of dioxin-like PCBs were detected in sediment from Blackbird Creek.

At most stations, octachlorodioxin was present at the highest concentrations compared with other congener groups. Concentrations of dioxin-like PCB in sediment collected from Nipigon Bay downstream of the local mill outfall were high compared with concentrations from other stations and higher than the octachlorodioxins. In fact, the dioxin-like PCBs made up more than half of the TEQ value. This was in contrast to the other samples where dioxin-like PCBs typically represented a small fraction of the TEQ. The presence of these compounds is likely associated with the mill since this station is located only 30 m downstream of the mill outfall.

## DISCUSSION

### *Nipigon Bay*

With few exceptions, water and sediment samples collected from Nipigon Bay did not suggest significant environmental impairments. There was some sediment contamination (i.e. dioxin-like PCBs, Hg, PAHs, PCBs, TOC), in the vicinity of the local pulp and paper mill and WPCP, but concentrations were not high enough to suspect impacts on the benthic community. In general, sediment samples showed that metal concentrations (Cr, Cu, Fe and Ni), were typically greater than the provincial SQG LEL at most stations. Arsenic, Pb, Zn and Hg (with the exception of station 459), were below the LEL at all stations. This was consistent with historical data, which did not indicate significant metal contamination but did show enrichment of Hg which was associated with the mill effluent (Ontario Ministry of Environment et al. 1991a).

Concentrations of nutrients (with the exception of total phosphorus), and bacteria in water were low. TON was slightly elevated downstream of the pulp and paper mill and local WPCP. However, in general, at all stations, TIN and TON concentrations were typically less than 200 µg/L with the exception of the stations closest to the mill and WPCP outfalls. The highest concentrations were in the spring coinciding with the highest concentrations of suspended solids (4 to 7 mg/L in the spring compared with < 5 mg/L in the summer and fall). Total phosphorus concentrations were typically between 4 and 8 µg/L at all stations sampled in the spring and summer survey with the exception of stations 459 and 1200 located 30 and 500 m, respectively, downstream of outfalls for the pulp and paper mill and Red Rock WPCP. Concentrations of TP were 40 µg/L at station 459 and 24 and 32 µg/L at station 1200 in the spring. Temperature and conductivity (measured by the Hydrolab), suggested the presence of a surface plume at station 459. The water temperature at 0.4 m below the surface ranged from 11 to 12.8 °C and



conductivity ranged from 209 to 281  $\mu\text{S}/\text{cm}$  while temperature at 1 to 1.5 m was 8.3 °C and conductivity was 150 to 157  $\mu\text{S}/\text{cm}$ . In the summer, only station 459 had higher TP concentrations (mean: 11  $\mu\text{g}/\text{L}$ ) than the other stations sampled and there was no evidence of a surface plume. Concentrations of TP in the fall were similar at all stations with the exception of the station near Frog Island where TP was 20  $\mu\text{g}/\text{L}$ . Chloride concentrations were low at all stations (<3 mg/L). Organic compounds in general and compounds associated with the pulp and paper industry in particular, were routinely below the method detection limit.

Water quality appears to have improved since the 1983 survey, which documented impairments to water and sediment due to effluent from the pulp and paper facility. In 1983, PWQOs for Cd, Fe, Hg, Cu and Zn were exceeded as were objectives for reactive phenol and guaiacol (Ontario Ministry of Environment et al. 1991a). In 1999 metal concentrations and parameters associated with the pulp and paper mill were all less than the PWQOs.

All water quality data from the survey area were consistent with data collected from the Nipigon Bay Index station which was located off shore in deeper water. Only Al concentrations in the spring samples were higher at the nearshore stations when compared with the Index station.

### *Jackfish Bay*

As with the data from Nipigon Bay, there were slightly elevated concentrations of some contaminants but sediment samples did not suggest significant environmental impairments. Sediment was contaminated in the bay, but concentrations were not high enough to suspect impacts on the benthic community. Concentrations of Cd, Cr, Hg, Zn, PAHs, TKN, TOC were highest at the station located about 300 m downstream of the mouth of Blackbird Creek (station 702). When sediment data was normalized to Al, concentrations at this station remained enriched with Cd, Hg and Zn relative to the other stations in the survey area. According to the RAP Stage 1 report (Jackfish Bay RAP Team, 1991), Hg and Zn have been linked to the effluent from the local pulp and paper mill located in Blackbird Creek about 14 km upstream from Moberly Bay.

Although concentrations were low, the Jackfish Bay station (451) located about 2.8 km downstream of the creek showed some enrichment of Cu and Pb relative to other stations sampled in the area. The sediment collected from the mouth of Blackbird Creek did not show any evidence of contamination. However, the samples were extremely high in sand (97%). Even when the data were normalized to Al, the ratio suggested low metal concentrations at this station. Arsenic, Pb, Hg and Zn (with the exception of station 702 and one sample from station 288), were below the LEL at all stations. All the sediment data were extremely consistent with historical data, suggesting little change in sediment quality over time.

Impacts from the mill effluent on water quality throughout Moberly Bay and the northern and western portions of Jackfish Bay that were obvious in the 1981 and 1987/89 surveys (i.e. nutrients, metals and phenols greater than the PWQO, high suspended solids), were not evident in the 1999 survey. The installation of secondary treatment at the mill has likely contributed to the improvement in water quality throughout the bay. Although it should be noted that this survey only represents one day of sampling per season and movement of the effluent plume is highly dependent on wind and current direction. However, notwithstanding the apparent improvement in water quality in Moberly Bay and Jackfish Bay, chloride concentrations and conductivity were clearly elevated at the mouth of Blackbird Creek similar to historical data, as were concentrations of TIN, TON and TP and suspended solids particularly in the spring and summer surveys. TP in the spring was 144  $\mu\text{g}/\text{L}$  at the mouth of the creek compared with concentrations in Moberly Bay and Jackfish Bay that were 16 and 4  $\mu\text{g}/\text{L}$  respectively. Also of note, were extremely high TP (440  $\mu\text{g}/\text{L}$ ) and ammonia/ammonium concentrations at this station



in the summer (1.16 mg/L). Dissolved oxygen was also lower at this station (5.5 mg/L) compared with all stations located further downstream (9 mg/L) and conductivity, measured using the Hydrolab was as high as 1,351  $\mu\text{S}/\text{cm}$ . In general, water quality at the mouth of Blackbird Creek was consistent with the 1987/88 data and does not appear to have improved.

Temperature and conductivity data collected using the Hydrolab suggested the presence of a surface plume at the mouth of Blackbird Creek in the spring. The temperature ranged from 12-13 °C and the average conductivity value measured 822  $\mu\text{S}/\text{cm}$  at 0.6 m depth at station 701. At 1.1 m depth, the temperature ranged from 7-11 °C and average conductivity was 477  $\mu\text{S}/\text{cm}$ . Further downstream at station 702 in Moberly Bay, the water temperature from the surface to a depth of 17 m ranged from 5.5-6.8 °C and conductivity at the surface was 150  $\mu\text{S}/\text{cm}$ . Downstream of Moberly Bay (station 710), water temperature from the surface to a depth of 29 m remained consistent at 4.25 °C and conductivity was 101  $\mu\text{S}/\text{cm}$ . Secchi depth measurements also improved with increasing distance away from the mouth of Blackbird Creek (from 0.2 m to 6.5 m in Jackfish Bay). TIN concentrations at the mouth of the creek were typically lower than concentrations at the remaining stations that were similar to concentrations in Lake Superior. The only metal consistently greater than the PWQO was Cr although given that the analysis was for total Cr, it is unclear what portion of the data represents the two ionic states applicable to the PWQO.

In general, all parameters showed a downward gradient with increasing distance from Blackbird Creek. Concentrations of most parameters in water samples collected from the Index station (288) were similar to concentrations detected in water collected from stations 710 and 451 which were located farther downstream of Moberly Bay.

### ***Pic River***

With the exception of one station (20), the sediment samples collected from the mouth of the Pic River and the nearby embayment were high in sand. Accordingly, metal and nutrient concentrations were low. When the data were normalized to Al to account for the high sand content of the samples the ratios suggested similar sediment quality to other areas in the survey. Sediment quality in the Pic River and embayment were not enriched with metals or nutrients and all concentrations were less than the LEL with the exception of TKN.

Although a sample was not collected directly from the mouth of the river in the spring, water collected from station 457 (west of the river mouth) was from the plume extending from the Pic River. The plume was extremely turbid with suspended solid concentrations at 3,520 mg/L. *E. coli* and fecal streptococci counts were 280 and 720 counts/100mL, respectively. This was in contrast to data collected from all the other surveys. As well, nutrient concentrations were high compared with the other stations sampled in the area. TON concentrations were 2,398  $\mu\text{g}/\text{L}$  at station 457 compared with concentrations that were less than 158  $\mu\text{g}/\text{L}$  at the remaining stations. TP was also high at 1220  $\mu\text{g}/\text{L}$  compared with concentrations that were between 4 and 12  $\mu\text{g}/\text{L}$ .

In the summer and fall, water collected from the river mouth and the plume extending into the embayment had higher concentrations of suspended solids, TP and organic nitrogen than the embayment station (station 20) and the Heron Bay station (21) located north of the Pic River. In contrast, stations 20 and 21 consistently had higher concentrations of TIN than the Pic River. With the exception of Al and Cr, metal concentrations were less than the PWQOs. High Al concentrations at the river mouth and stations 457 and 454 were likely associated with the higher suspended solids concentrations in those samples.

Although the surveys were representative of one day per season, the spring data in particular



suggested that the Pic River has impaired water quality and could be a significant source of nutrients and bacteria.

### *Spanish River*

Sediment samples collected from stations located downstream of the mouth of the Spanish River were contaminated with Cu, Fe, Mn and Ni. Concentrations of these metals in sediment at several stations were greater than the SEL. The highest concentrations were at two stations in the Whalesback Channel (station 401 and 209), but the impact from contaminant sources upstream in the Spanish River was evident throughout the area extending into Aird Bay and the McBean Channel. The station located at the mouth of the river (400) had the lowest metal concentrations, in part, due to the high sand content of the sample but was indicative of the flow pattern from the river suggesting deposition zones in the Whalesback Channel. This pattern of sediment contamination was consistent with sediment surveys in the 1980's and 1990's and was attributed to the local mining and smelting industry which has been operating in the area since the 1930's (Spanish Harbour RAP Team 1993).

Sediment collected from the Index station (39) was also contaminated with dioxins and furans. High TEQ values were generally due to high concentrations of 2,3,7,8-tetrachlorodibenzofuran and octachlorodibenzo-dioxin. The dioxin contamination was likely a result of effluent discharged from E.B Eddy Forest Products pulp and paper mill to the Spanish River.

Since 1993, the E.B. Eddy mill has been upgraded and the Espanola WPCP installed secondary treatment. Accordingly, downstream water quality was expected to improve when compared with water samples collected from the late 1980's when Ni and Cu concentrations were greater than the PWQOs in at least 50% of the samples collected from the Spanish River. As well, Pb, Cd, Fe and Zn concentrations were occasionally greater than the PWQOs. In the 1999 survey, all metal concentrations were below the PWQO with the exception of Ni (PWQO: 25  $\mu\text{g/L}$ ), at the mouth of the Spanish River in the spring (27.6  $\mu\text{g/L}$  +/- 1.7  $\mu\text{g/L}$ ). Ni concentrations were consistently high at all stations in the survey area (21  $\mu\text{g/L}$ ) during the spring. In the summer and fall concentrations were lower but the highest concentration was always present at the station at the mouth of the river.

Chloride concentrations were, in general, higher in the Whalesback Channel and surrounding stations than in samples collected from other survey areas. Nutrient concentrations (nitrogen and phosphorus) and suspended solids were consistent among the sampling stations and generally low. TIN concentrations were typically less than 300  $\mu\text{g/L}$  and TP concentrations were less than 12  $\mu\text{g/L}$ . The highest concentrations tended to be present in samples collected from the mouth of the river.

The Index station was located downstream of the mouth of the Spanish River in the Whalesback Channel. Concentrations of all parameter in samples collected from the Index station were similar to water quality throughout the survey area.

### *Thunder Bay*

Water quality impairments in Thunder Bay are primarily due to discharges from the forest product industry (pulp and paper and wood preservation). Direct discharges to Thunder Bay include Abitibi-Price Inc. (Fort Williams Division, Thunder Bay Division and Provincial Papers Division) and Northern Wood Preservers Ltd. The Ontario Hydro Thermal Generating Station, Canadian Pacific Forest Products, Ogilvie Mills and the Thunder Bay STP discharge to Lake Superior via the lower Kam River. Other local industries also contribute to water quality



impairments. However, over the past thirty years water quality has improved following improvements made by industry.

The Thunder Bay RAP identified the Kam River, the inner Thunder Bay Harbour and Chippewa Beach as the areas of most serious degradation (Ontario Ministry of Environment et al. 1991). Results in 1999 were similar to previous studies in that the most degraded area was identified as the lower Kam River with a zone of impact that radiates out from its delta.

Previous surveys in 1983 and 1985/86 have identified the Kam River as a source of nutrients, metals and conventional parameters such as CI and BOD (Ontario Ministry of Environment et al. 1991). In 1983, CI and TP concentrations were higher downstream of the Canadian Pacific Forest Products outfall than upstream, and high nutrient (TP and nitrogen) concentrations were detected in water in the Kam downstream of the STP. The 1999 water quality data for TP, TIN and CI followed a similar pattern. TP was greater than the PWQO in samples associated with the Kam River (range 48 to 72  $\mu\text{g/L}$ ). The Kam River is a source of organic material to the bay and has higher concentrations of TON than Lake Superior. The source of inorganic nitrogen to Lake Superior is likely atmospheric, the smaller area of the Kam River compared with the lake is likely responsible for the lower TIN concentrations in the rivers. However, consistently for all three surveys, the highest concentration of inorganic nitrogen was detected at the mouth of the Kam River downstream of the STP suggesting the STP as a source of nitrate and ammonia/ammonium. The 1999 data for metals was also consistent with earlier studies whereby concentrations of metals in general were higher in the Kam River than at other stations sampled.

Trichlorophenols, resin acids and fatty acids were detected in water collected from the mouths of the tributaries and from the Kam River in the 1983 survey, and pentachlorophenol and trichlorophenol were detected in samples collected from stations near Welcome Island. In 1985, total resin acids and dehydroabietic acid was greater than the PWQO in the Kam and Mission River on occasion and trichlorophenols were present at trace concentrations. The pulp and paper mills in Thunder Bay were the sources of these compounds. In comparison with these earlier surveys, in 1999 only reactive phenols were detected in samples collected from Thunder Bay. In the spring, samples associated with the Kam River had trace concentrations of reactive phenols while in the fall, water samples from all the stations in the survey had trace concentrations although they were consistently below the PWQO.

Previous studies have identified three areas with sediment contamination; the Kam River and its delta, the inner harbour and the area adjacent to the Northern Wood Preservers (NWP) site in the inner harbour (Ontario Ministry of Environment et al. 1991). The NWP site has been extensively studied so it was not included in this survey. The results from the survey in 1999 were similar to the survey in 1985 both in terms of the concentrations detected at the stations and the patterns of contamination. However, in general, Cu, Cr and Hg concentrations were lower in 1999 than in 1985.

When normalizing the sediment data to Al, the sample collected from outside the Provincial Paper filtration bed was enriched with Hg, Pb, Cu, and Cd compared with the remaining stations in the survey, followed by the Welcome Island Index station and station 802 in the Kam River which also showed enrichment relative to the remaining stations in the survey. Mn and Fe concentrations were very low in the sample from the filtration bed compared to the other stations while As was enriched in the Kam, the Mission and McKellar Rivers.



## *Peninsula Harbour*

There are two point sources discharging into the Peninsula Harbour study area: the Fort James Marathon kraft pulp mill (formerly James River-Marathon Ltd.) and the town of Marathon WPCP. Prior to 1983, the kraft mill discharged its effluent via four outfalls directly to Peninsula Harbour (which included Hg from the chlor-alkali plant). This historical discharge of Hg (from improperly treated wastewater, spills, leaks and vapour loss) (Peninsula Harbour RAP Team 1991), was responsible for the Hg contamination in the sediment in Jellicoe Cove which is still evident from the 1999 survey. Mercury concentrations in sediment detected at the two stations in Jellicoe Cove (station 276 and 279) were similar to concentrations reported in a 1991 survey (Smith, 1992). Consistent with previous sediment surveys (Jardine and Simpson, 1990), PCB contamination was also detected in sediment from Jellicoe Cove (station 276) and Beatty Cove, although concentrations were lower than in 1984. The PCB contamination is thought to have originated from the pulp and paper mill or the chlor-alkali plant (Smith, 1992). This was also likely the source of the PAHs and chlorinated benzenes detected in the sediment in 1999 at the same station in Jellicoe Cove. The sediment concentration of the other trace metals (Cr, Cu, Pb, Cd, Ni, Zn etc.) in 1999 was similar to concentrations detected in 1984 (Jardine and Simpson, 1990). From 1983 to 1995, effluent from the pulp mill was pumped over the ridge of the Peninsula into a control basin and then discharged offshore into open Lake Superior via a submerged outfall. At times, effluent overflows were still discharged into Peninsula Harbour. In 1995, the kraft mill's outfall was moved further downstream south of the Peninsula (and south of the WPCP), and the effluent was discharged through a submerged diffuser into Lake Superior after going through a secondary treatment basin. Although there were significant water quality improvements in the vicinity of the mill's outfall since the 1970's due to improvements to the mill and the relocation of the outfall in 1983, PWQOs for some metals and organic compounds were exceeded in 1984/85. In contrast, in 1999 the PWQO was not exceeded for any parameters in samples collected upstream and downstream of the new outfall and concentrations of all parameters were similar (nutrients and metals) at the two stations. Parameters typically associated with the mill effluent such as resins and fatty acids, total reactive phenolics and chlorinated phenols were not detected in any water samples. As well, these parameters were not detected in Jellicoe Cove where the mill historically discharged its effluent. Chloride concentrations downstream of the mill were lower in 1999 than in 1984/85 (measured near the previous mill outfall) as were TP concentrations.

The WPCP also discharges into Lake Superior south of the Peninsula through a submerged outfall (diffuser). Water quality associated with the plant improved considerably when the plant was upgraded to secondary treatment in 1982. Prior to the upgrade, bacterial contamination was a problem. Consistent with data from 1984/85, bacterial contamination in the study area was low (or below the detection limit).

Water concentrations of ammonia, TKN and nitrate in 1999 were similar to concentrations in 1984/85 as were concentrations of metals in most cases.

The sediment trace metal data was also consistent with previous surveys and highlighted the historic Hg and PCB contamination in Jellicoe Cove. Normalization of the sediment data to Al showed enrichment of As, Cu, Pb and Zn at station 276 in Jellicoe Cove and at the Hawkins Island station relative to stations located south of the Peninsula although in general, with the exception of Hg, concentrations at all stations were not high enough to be of significant biological concern (i.e. < SEL).



## RECOMMENDATIONS

The data suggests that sediment quality in Nipigon Bay, Jackfish Bay and the Pic River does not appear to be a significant risk to sediment dwelling organisms. As such, additional sediment surveys are not recommended unless there is reason to suspect additional sources of contamination that were not captured in this survey or the need for a more detailed sediment survey. Data from the Spanish River suggests that sediment contamination in the AOC is persistent and consistent with previous surveys. The Spanish Harbour RAP Stage 2 report has recommended a strategy of natural recovery due to the large area that is contaminated (Spanish Harbour RAP Team 1997). Additional long-term monitoring to assess improvements in sediment quality and benthic community structure is therefore recommended.

Water quality in the Spanish River has improved since studies from the 1980's, but high concentrations of nickel suggest some impairment. Water quality data at the mouth of Blackbird Creek (Jackfish Bay), suggested impairment due to high nutrient concentrations and low dissolved oxygen, although conditions in Moberly Bay and Jackfish Bay have improved greatly since surveys from the late 1980's. Monitoring of water quality in the Spanish River, Blackbird Creek and the Pic River should be repeated in the future. The source of high bacteria and nutrient loads to the Pic River should be investigated further.

The environmental impacts and strategies for management of Hg contaminated sediment in Thunder Bay and Peninsula Harbour is being addressed through the respective RAPs. Future monitoring of these areas should be coordinated with that program.

## REFERENCES

- Beak International Incorporated. 1999. Mercury investigation in Thunder Bay Harbour sediment - 1997 and 1998. Beak Ref. 20872.2
- Forstner, U., and Wittmann, G.T.W. 1983. Metal Pollution in the Aquatic Environment. 2<sup>nd</sup> Revised Ed. Springer-Verlag. Berlin Heidelberg New York Tokyo.
- Forstner, U. 1990. Inorganic sediment chemistry and elemental speciation. In Baudo, R., Giesy, J.P. and H. Muntau (Eds.) Sediments: Chemistry and Toxicity of In-Place Pollutants. Lewis Publishers, United States. 61-106.
- Jardine, C.G. and K.J. Simpson. 1990. Water and Sediment Quality Assessment of Peninsula Harbour, Lake Superior - Spring 1984 and 1985. Ontario Ministry of Environment.
- Jackfish Bay RAP Team. 1991. Jackfish Bay Area of Concern. Environmental Conditions and Problem Definition. Remedial Action Plan Stage 1.
- Kirby, M. 1986. Effect of waste discharge on the water quality of Nipigon Bay, Lake Superior. Ontario Ministry of the Environment.
- Krumgalz, B.S., Fainshtein, G. and Cohen, A. 1992. Grain size effect on anthropogenic trace metal and organic matter distribution in marine sediments. Sci. of Tot. Env. 116: 15-30.
- Ministry of the Environment (MOE). 1983. Handbook of Analytical Methods for Environmental Samples. Laboratory Services and Applied Research Branch. Toronto, Ontario.



- Ministry of the Environment (MOE). 1989a. The determination of trace metals in sediments by the spectro inductively coupled plasma-optical emission spectrometer (ICP-OES). Laboratory Services Branch, Etobicoke, Ontario.
- Ministry of the Environment (MOE). 1989b. The determination of mercury in soils, sediments and vegetation by cold vapour-atomic absorption spectrophotometry (CV-AAS). Laboratory Services Branch. Etobicoke, Ontario.
- Ministry of Environment and Energy (MOEE). 1994. Policies, Guidelines, Provincial Water Quality Objectives of the Ministry of Environment and Energy.
- Ministry of Environment and Energy (MOEE). 1994a. The Determination of Polychlorinated Biphenyls (PCBs), Organochlorines (OCs) and Chlorobenzenes (CBs) in Soil and Sediments by Gas Liquid Chromatography-Electron Capture Detection (GLC-ECD). PSAOC-E3270A. Laboratory Services Branch, Quality Management Office. Etobicoke, Ontario. July 18, 1994. 37 pp.
- Ministry of Environment and Energy (MOEE). 1994b. The Determination of Polynuclear Aromatic Hydrocarbons in Soil and Sediments by Gel Permeation Chromatography-high Performance Liquid Chromatography (PC-HPLC). PSAPAH-E3350A. Laboratory Services Branch, Quality Management Office. Etobicoke, Ontario. July 20, 1994. 28 pp.
- Ministry of Environment and Energy (MOEE). 1995a. The Determination of Total Kjeldahl Nitrogen and Total Phosphorus in Soil and Sediments by Colourimetry (NPSED-E3116A). Laboratory Services Branch, Etobicoke, Ontario.
- Ministry of Environment and Energy (MOEE). 1995b. The Determination of Particle Size on Sediment Samples by Microtrac Particle Size Analyzer Model 7991-2. PZSIZE-E3262A and SMPART-E3128A. Laboratory Services Branch, Quality Management Office. Etobicoke, Ontario.
- Ministry of Environment and Energy (MOEE). 1995c. The Determination of Polychlorinated Dibenzo-*p*-Dioxins and Dibenzofurans in Soil and Sediment by GC-MS. PSAFD-E3151B.. Laboratory Services Branch, Quality Management Office. Etobicoke, Ontario.
- Ministry of Environment and Energy (MOEE). 1995d. The determination of solids in water and surface water by gravitmetry (SOLIDS-E3365A). Laboratory Services Branch, Etobicoke, Ontario.
- Ministry of Environment and Energy (MOEE). 1995e. The Determination of Moisture Content, RST, RSTA and LOI of Sediments and Biomaterials by Gravimetry (PHYSOLID-E3139A). Laboratory Services Branch, Etobicoke, Ontario.
- Ministry of Environment and Energy (MOEE). 1995f. The determination of chloride in surface water, sewage and industrial waste by colourimetry (COCL-E3016A). Laboratory Services Branch, Etobicoke, Ontario.
- Ministry of Environment and Energy (MOEE). 1995g. The determination of ammonia nitrogen, nitrite, nitrite + nitrate nitrogen and reactive phosphorus in surface water, drinking water and precipitation by colourimetry (RNDNP-E3364A). Laboratory Services Branch,



Etobicoke, Ontario.

- Ministry of Environment and Energy (MOEE). 1995h. The determination of total kjeldahl nitrogen and total phosphorus in water, precipitation and soil extracts by colourimetry (RNDNP-E3367A). Laboratory Services Branch, Etobicoke, Ontario.
- Ministry of Environment and Energy (MOEE). 1995i. Membrane filtration methods for the detection of fecal coliforms, *Escherichia coli*, *Pseudomonas aeruginosa*, Fecal streptococci and total aerobic heterotrophic bacteria (MICROMF-E3371A). Laboratory Services Branch, Etobicoke, Ontario.
- Ministry of Environment and Energy (MOEE). 1996. The Determination of Polychlorinated Biphenyls (PCBs) in Soil and Solid Industrial Waste by Gas Chromatography-Electron Capture Detection (GC-ECD) (PSAPCB-E3153A). Laboratory Services Branch, Etobicoke, Ontario.
- Ministry of Environment and Energy (MOEE). 1997a. The Determination of Trace Metals in Surface Waters by Inductively Coupled Plasma-Mass Spectroscopy (ICP-MS) Using An Internal Standardization Procedure (SWATER-E3391A). Laboratory Services Branch, Etobicoke, Ontario.
- Ministry of Environment and Energy (MOEE). 1997b. The Determination of Mercury in Water by Cold Vapour-Atomic Absorption Spectrophotometry (CV-AAS) (HGWATER-E3060B). Laboratory Services Branch, Etobicoke, Ontario.
- Ministry of Environment and Energy (MOEE). 1997c. The Determination of Arsenic, Selenium and Antimony in Water and Effluents by Hydride Generation-Flameless Atomic Absorption Spectrophotometry (HYD-FAAS) (HYDMISC-E3089A). Laboratory Services Branch, Etobicoke, Ontario.
- Ministry of Environment and Energy (MOEE). 1997d. The Determination of total carbon in sediments by the LECO carbon analyzer. CARBONTC-E3142A. Laboratory Services Branch, Etobicoke, Ontario.
- Ontario Ministry of Environment, Environment Canada, Ontario Ministry of Natural Resources, Department of Fisheries and Oceans. 1991. Thunder Bay Area of Concern Remedial Action Plan Stage 1: Environmental Conditions and Problem Definition.
- Ontario Ministry of Environment, Environment Canada, Ontario Ministry of Natural Resources, Department of Fisheries and Oceans. 1991a. Nipigon Bay Remedial Action Plan Stage 1: Environmental Conditions and Problem Definition.
- Mudroch A., Sarazin, L. and T. Lomas. 1988. Summary of Surface and Background Concentrations of Selected Elements in the Great Lakes Sediments. *J. Great Lakes Res.* 14(2):241-251
- Peninsula Harbour RAP Team. 1991. Peninsula Harbour Area of Concern. Environmental Conditions and Problem Definition. Remedial Action Plan Stage 1.
- Peninsula Harbour RAP Team. 1997. Peninsula Harbour Remedial Action Plan. Stage 2: Remedial Strategies for Ecosystem Restoration. Draft.



- Persaud, D., Jaagumagi, R., and Hayton, A. 1992. Guidelines for the protection and management of aquatic sediment quality in Ontario. Water Resources Branch. Ontario Ministry of the Environment. Toronto, Ontario.
- Richman, L.A. 2001. Great Lakes Reconnaissance Survey - Lake Erie Harbours Water and Sediment Quality 1998. Environmental Monitoring and Reporting Branch. Ontario Ministry of Environment. (In press).
- Smith, I.R. 1992. 1991 Peninsula Harbour Sediment Study. Great Lakes Section. Water Resources Branch. Ministry of Environment. Draft.
- Spanish Harbour RAP Team. 1993. Spanish Harbour Area of Concern. Environmental Conditions and Problem Definition. Remedial Action Plan Stage 1.
- Spanish Harbour RAP Team. 1997. Spanish Harbour Area of Concern. Stage 2 - Remedial Actions Towards Ecosystem Restoration..
- van den Berg, M., L. Birnbaum, B.T.C. Bosveld., B. Brunstrom, P. Cook, M. Feeley, J.P. Giesy, A. Hanberg, R. Hasegawa, S.W. Kennedy, T. Kubiak, J.C. Larsen, F.X. Rolaf van Leeuwen, A.K.D. Liem, C. Nolt, R.E. Peterson, L. Poellinger, S.Safe, D. Schrenk, D. Tillit, M. Tysklind, M. Younes, F. Waern, and T. Zacharewski. 1998. Toxic equivalency factors (TEFs) for PCBs, PCDDs, PCDFs for humans and wildlife. Environ. Health Perspect. 106:775-792.



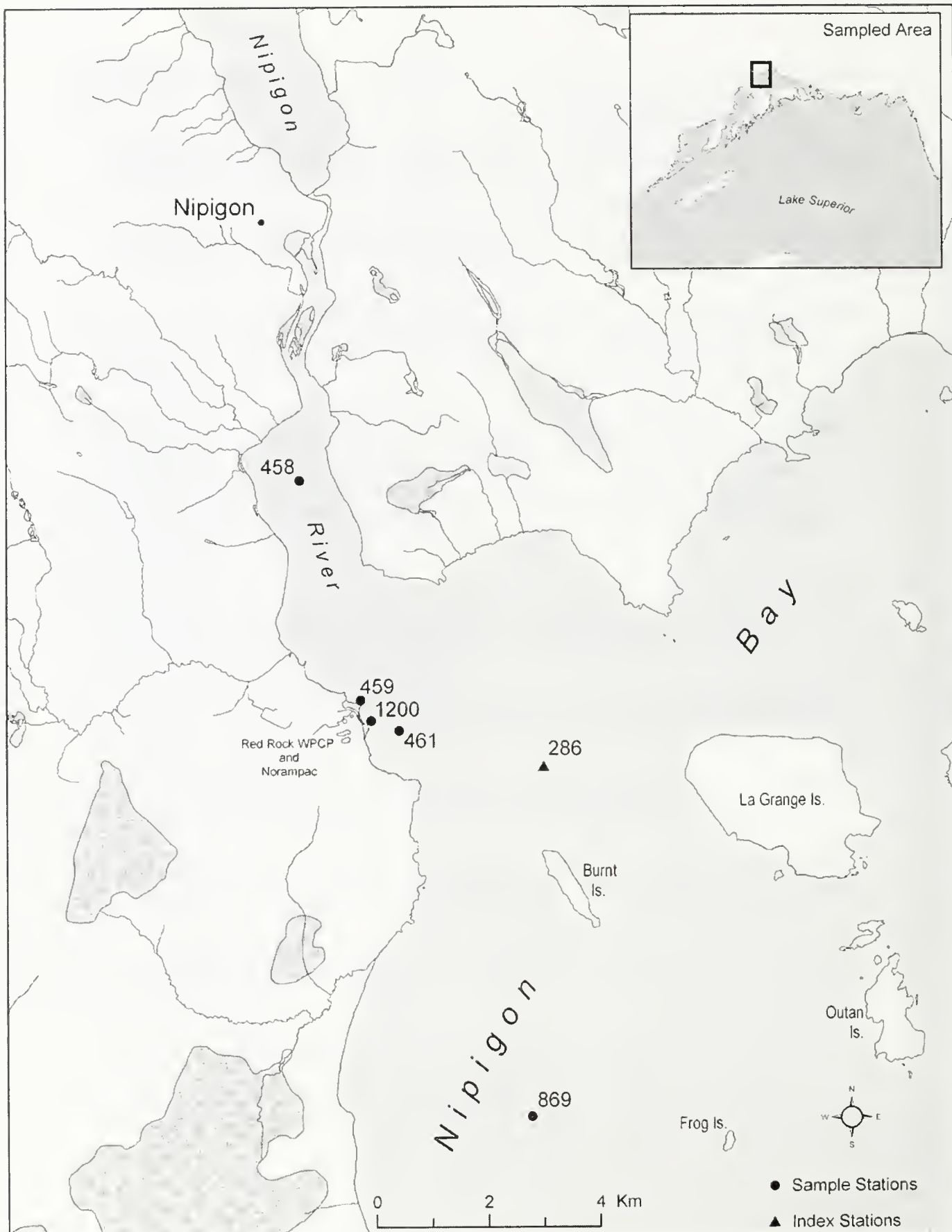


Figure 1: Nipigon Bay sediment and water sampling stations, 1999



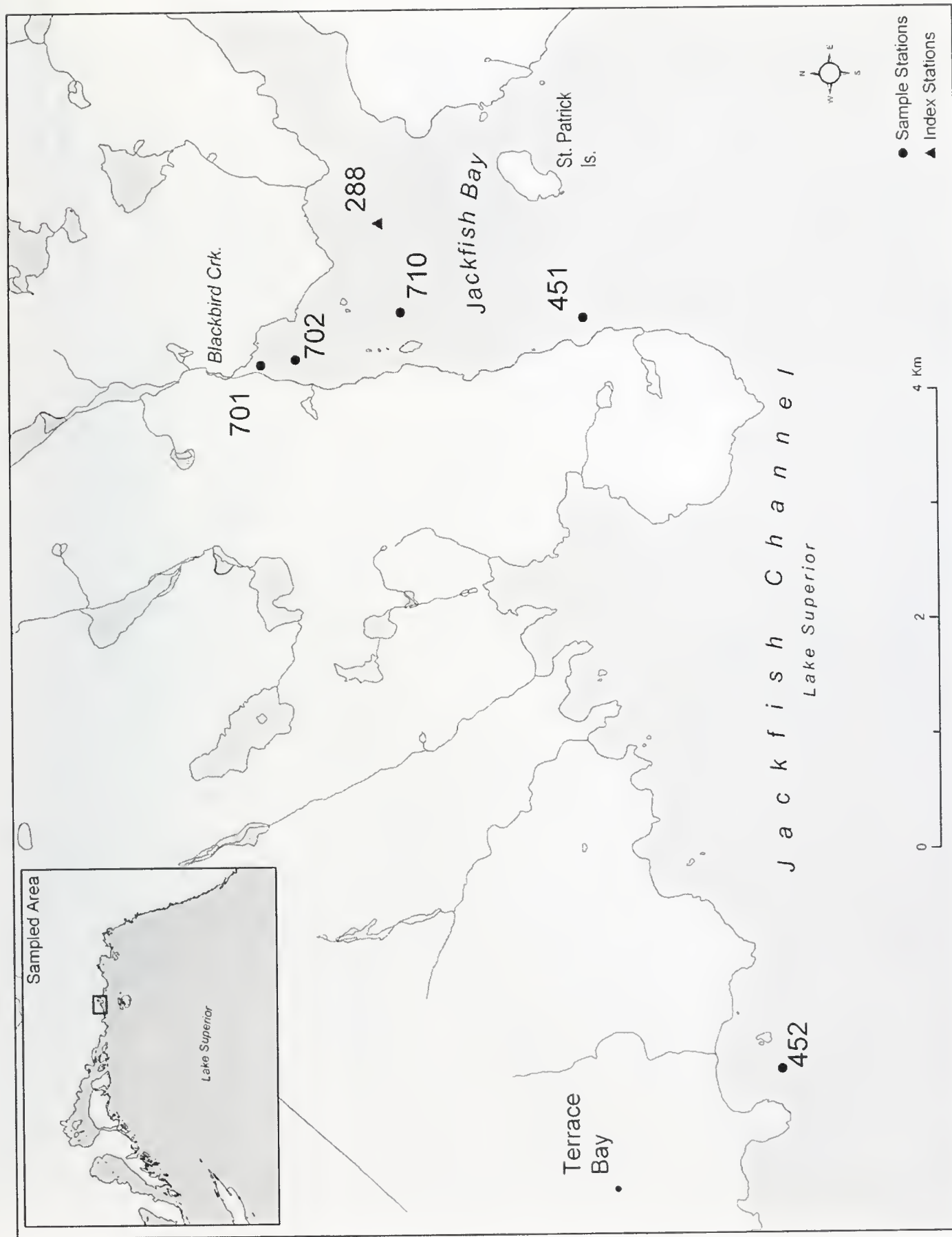


Figure 2: Jackfish Bay sediment and water sampling stations, 1999



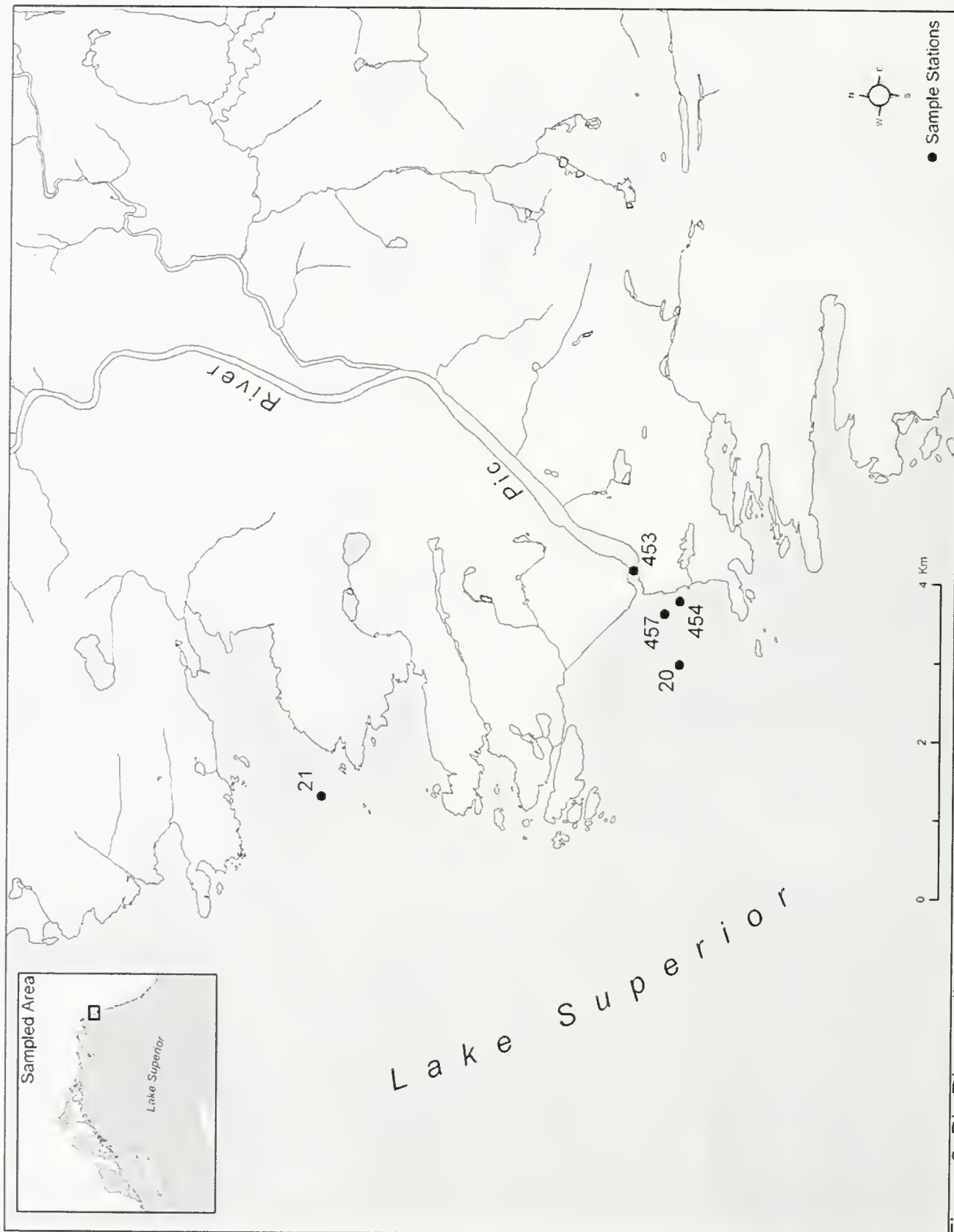


Figure 3: Pic River sediment and water sampling stations, 1999



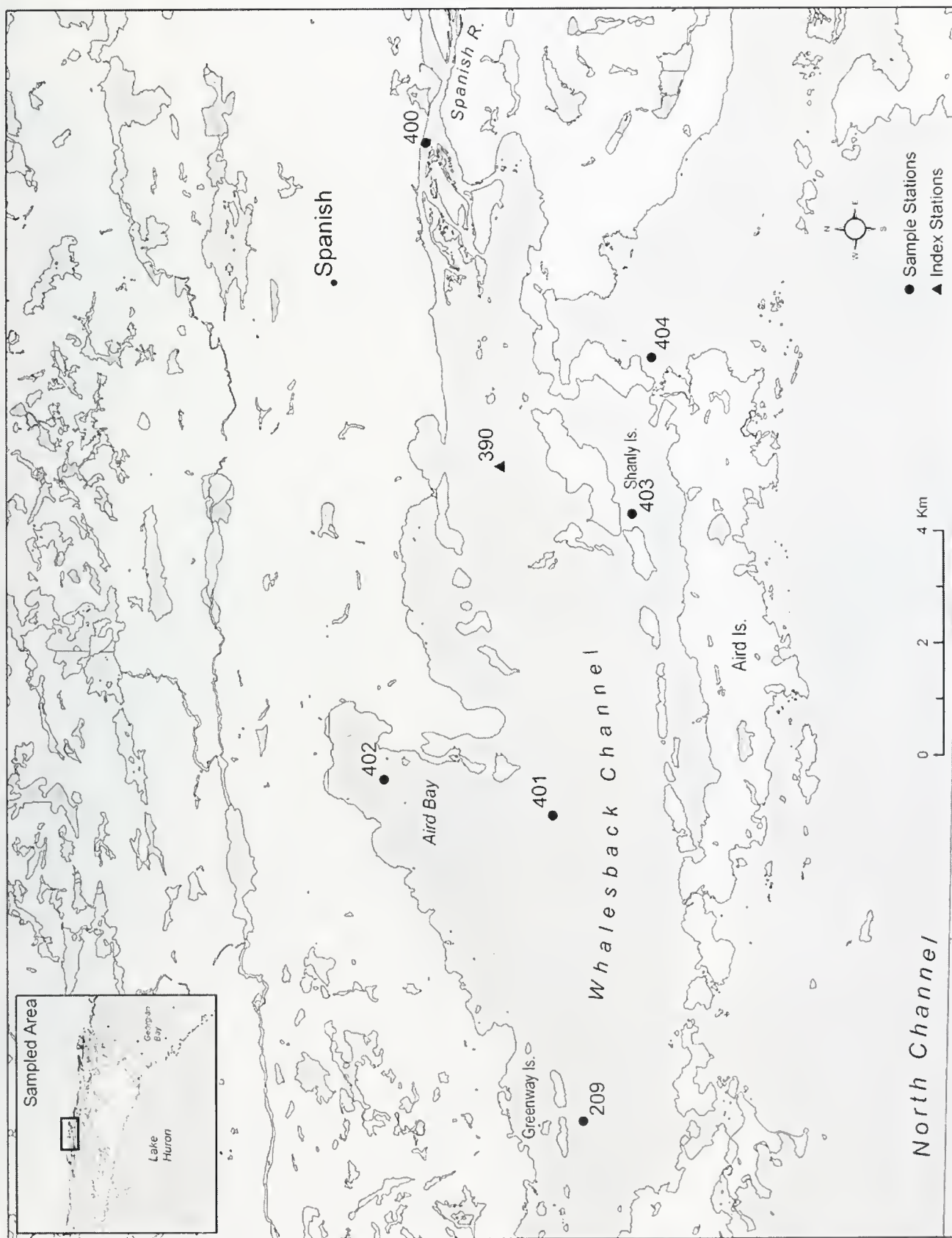


Figure 4: Spanish River (mouth) and Whalesback Channel sediment and water sampling stations, 1999



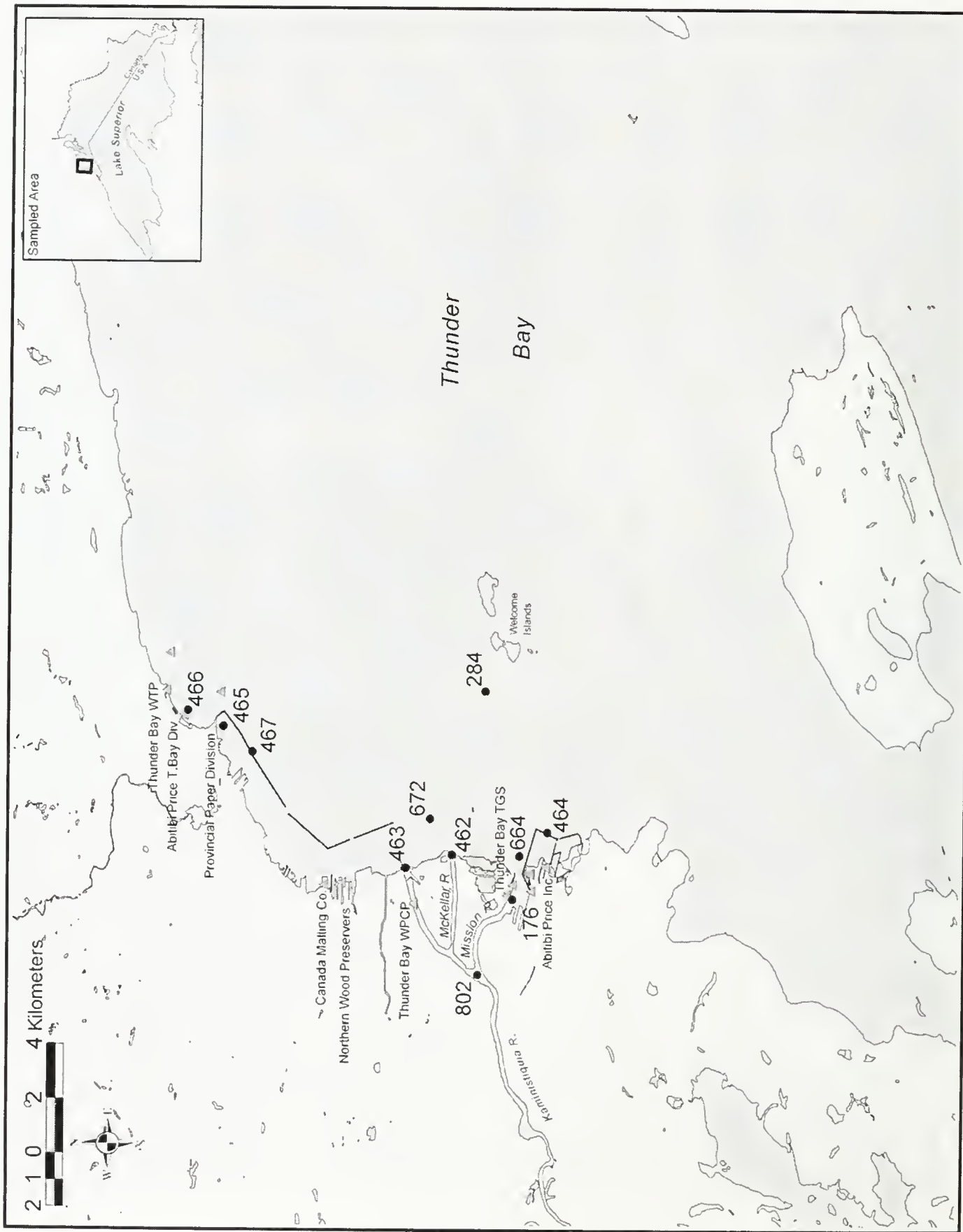


Figure 5: Thunder Bay sediment and water sampling stations, 1999



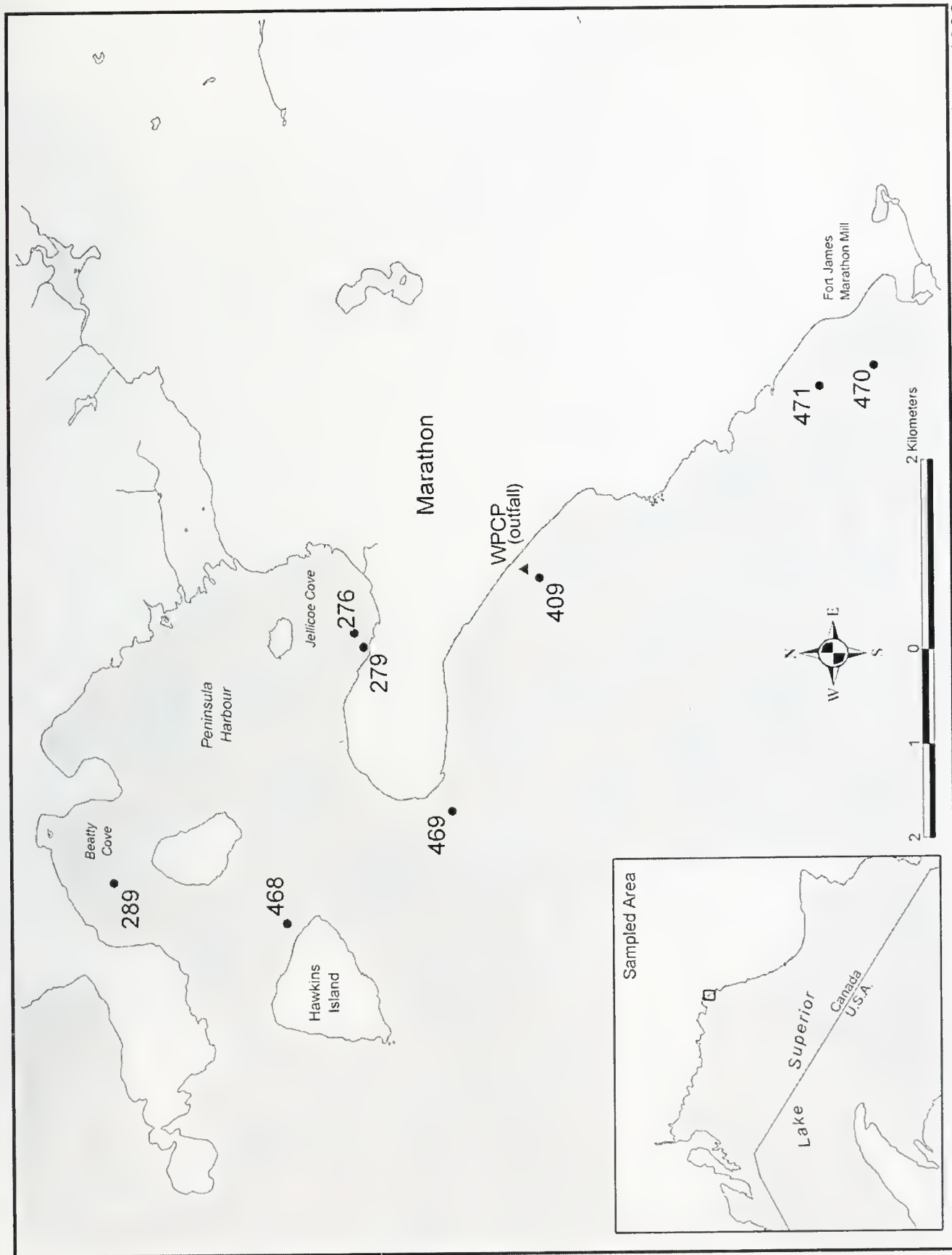


Figure 6: Peninsula Harbour sediment and water sampling stations, 1999



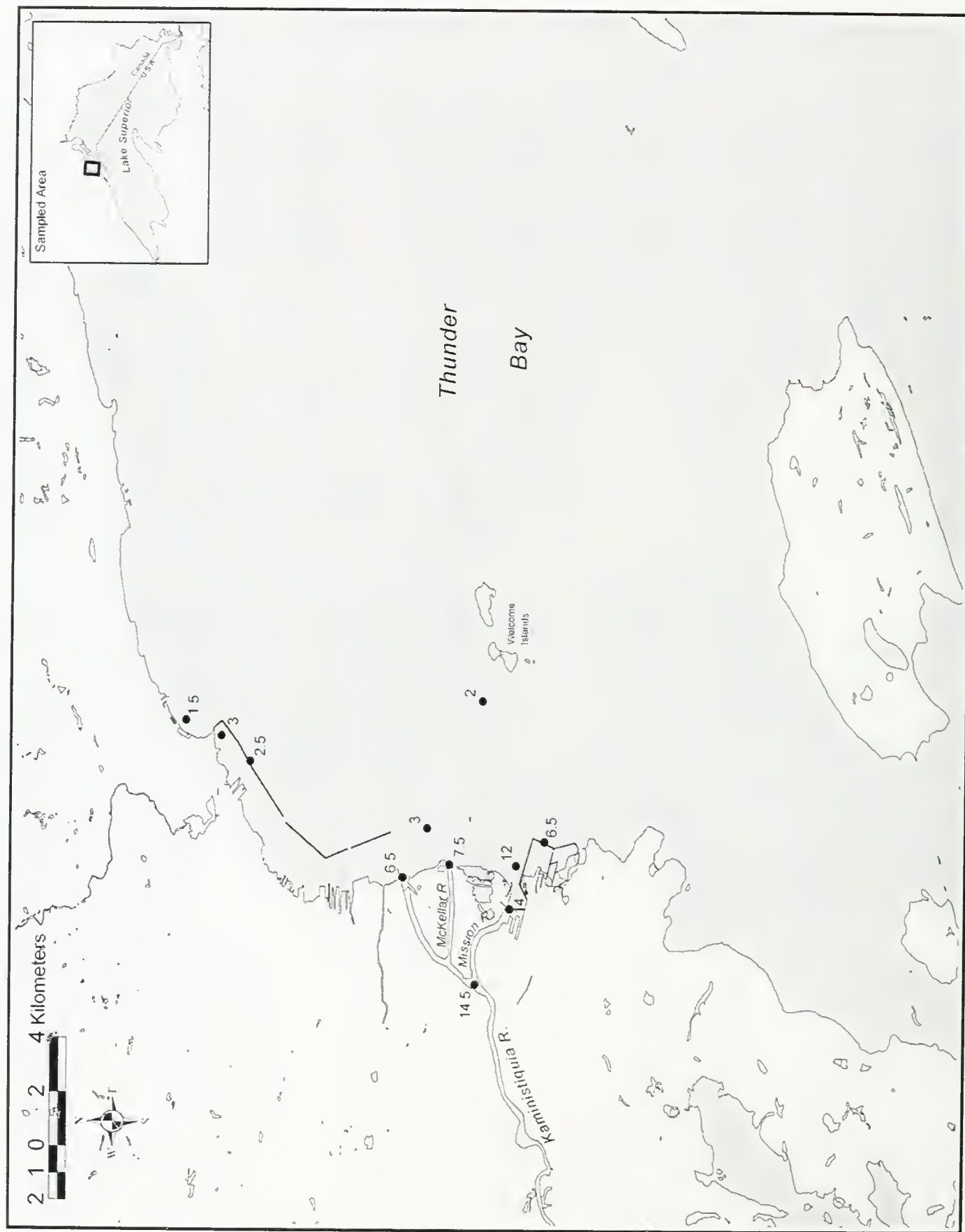


Figure 7: Spring suspended solids concentrations (mg/L), Thunder Bay, 1999



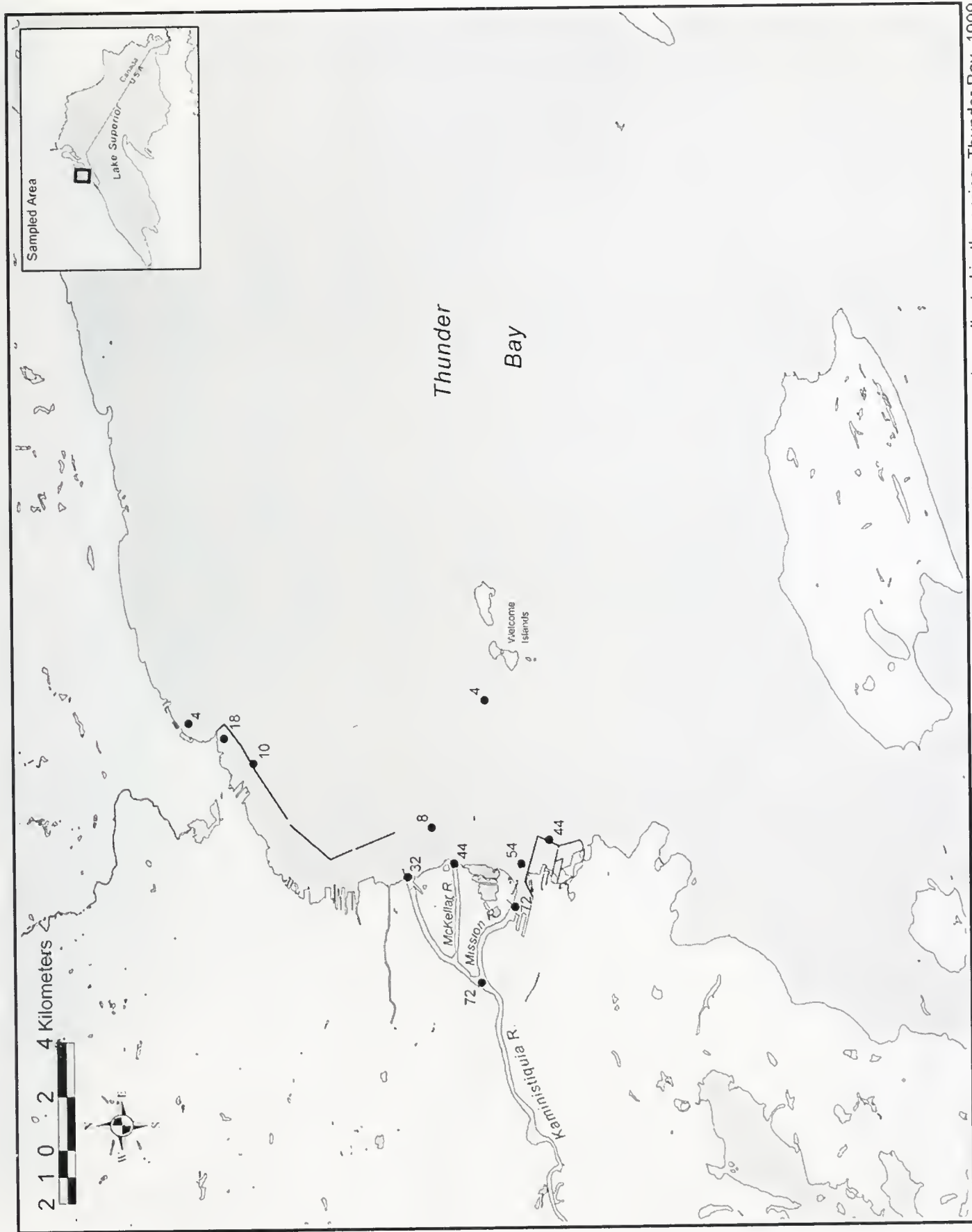


Figure 8: Total phosphorus concentrations ( $\mu\text{g/L}$ ) in water samples collected in the spring, Thunder Bay, 1999



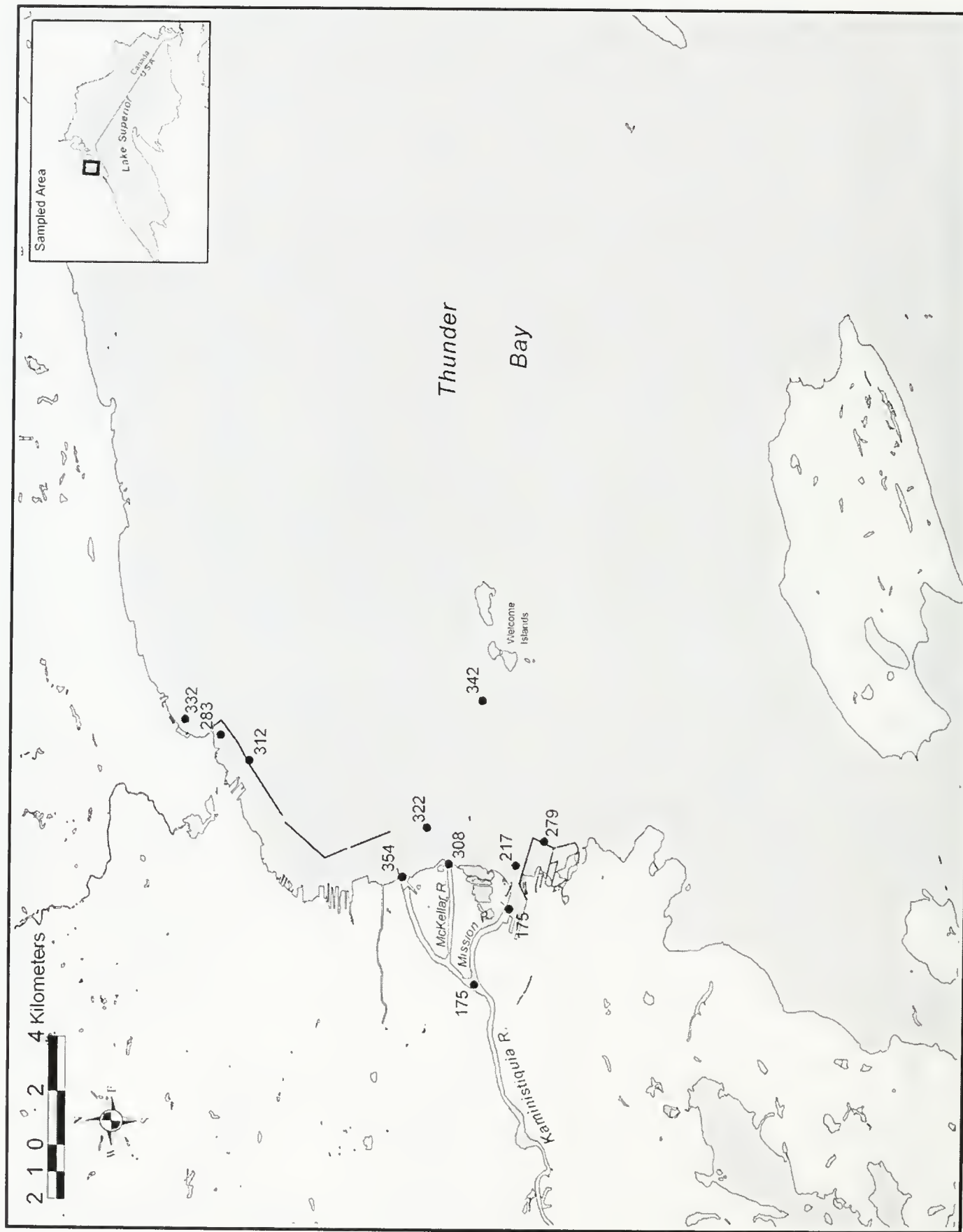


Figure 9: Total inorganic nitrogen concentrations (ug/L) in water samples collected in the spring, 1999



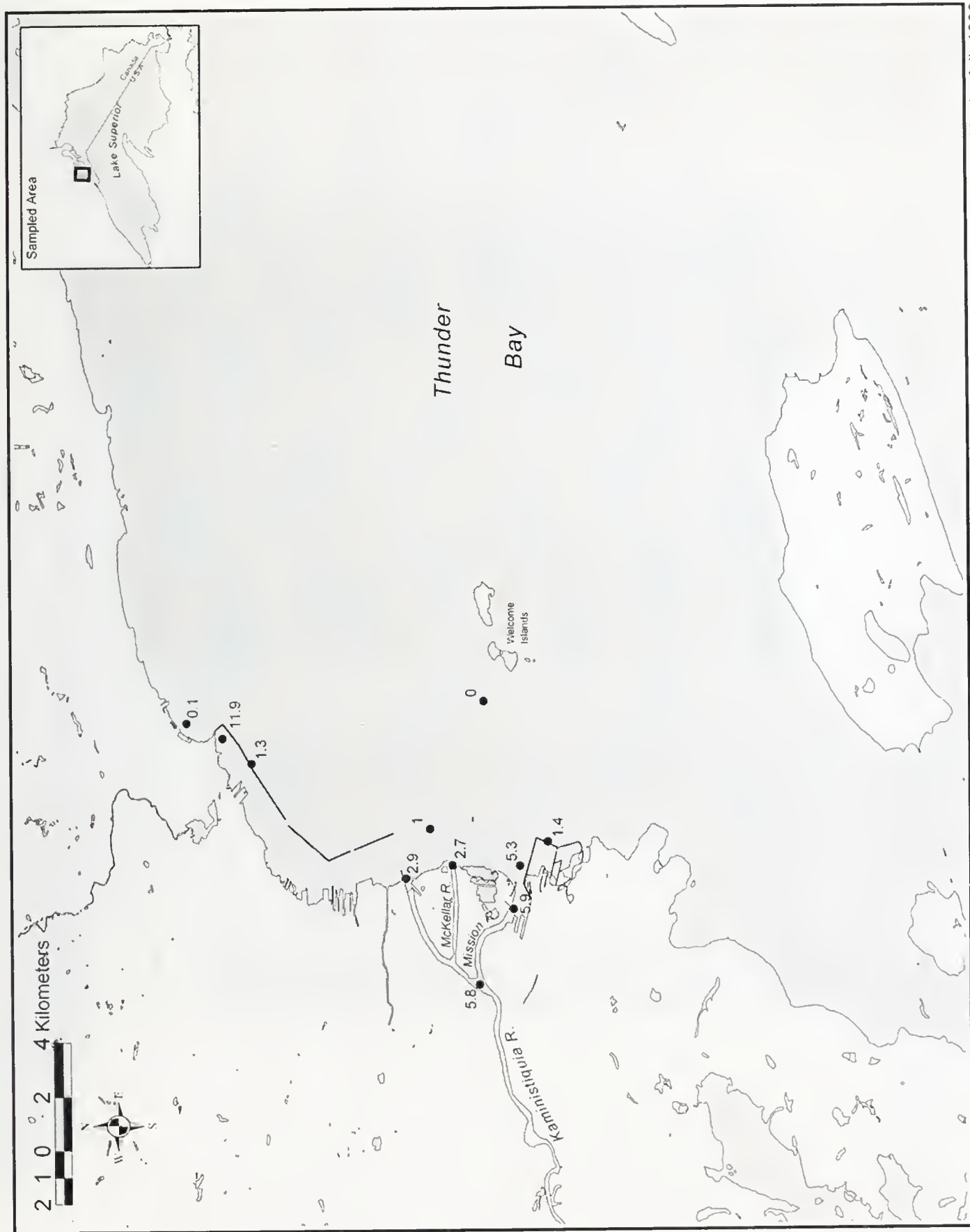


Figure 10: Mercury concentrations (ng/L) in water samples collected in the fall, 1999



Table 1: Nutrient concentrations and other water quality parameters for samples collected from Lake Superior and the Spanish River, 1999

| Station Description                       | Station number | Field Sample number | Date YYYYMMDD | Sample Depth (m) | Water Depth (m) | Secchi Depth (m) | E. coli count/100mL | Fecal Streptococci count/100mL | Pseudomonas aeruginosa count/100mL | Chloride mg/L | Conductivity (field) $\mu$ S/cm 25 C |
|---|----------------|---------------------|---------------|------------------|-----------------|------------------|---------------------|--------------------------------|------------------------------------|---------------|--------------------------------------|
| <b>Spanish River</b>                      |                |                     |               |                  |                 |                  |                     |                                |                                    |               |                                      |
| <i>Spring</i>                             |                |                     |               |                  |                 |                  |                     |                                |                                    |               |                                      |
| Mouth of Spanish River                    | 14             | 1                   | 19990501      | 1.0              | 2.2             | 1.1              | 4                   | 2                              | 0                                  | 10.8          |                                      |
| Whalesback Channel                        | 14             | 1                   | 19990501      | 1.5              | 2.9             | 2.0              | 2                   | 2                              | 0                                  | 8.8           |                                      |
| Whalesback Channel (near Greenway Island) | 14             | 1                   | 19990501      | 1.5              | 16.0            | 2.4              | 2                   | 2                              | 0                                  | 8.4           |                                      |
| Ard Bay                                   | 14             | 1                   | 19990501      | 1.5              | 8.0             | 2.7              | 2                   | 2                              | 0                                  | 8.6           |                                      |
| Ard Bay                                   | 14             | 1                   | 19990501      | 1.5              | 8.0             | 2.7              | 2                   | 2                              | 0                                  | 8.4           |                                      |
| Near Shelly Island                        | 14             | 1                   | 19990501      | 1.5              | 11.8            | 1.8              | 2                   | 2                              | 0                                  | 8.6           |                                      |
| Near Little Detroit                       | 14             | 1                   | 19990501      | 1.5              | 30.5            | 8.0              | 2                   | 2                              | 0                                  | 4.8           |                                      |
| <i>Summer</i>                             |                |                     |               |                  |                 |                  |                     |                                |                                    |               |                                      |
| Mouth of Spanish River                    | 14             | 1                   | 19990801      | 1.0              | 2.2             | 1.0              | 4                   | 4                              | 2                                  | 20.4          |                                      |
| Whalesback Channel                        | 14             | 1                   | 19990801      | 1.5              | 22.6            | 3.0              | 4                   | 4                              | 2                                  | 7.2           |                                      |
| Whalesback Channel (near Greenway Island) | 14             | 1                   | 19990801      | 1.5              | 14.9            | 4.0              | 4                   | 4                              | 2                                  | 7.0           |                                      |
| Ard Bay                                   | 14             | 1                   | 19990801      | 1.5              | 8.1             | 3.8              | 4                   | 4                              | 2                                  | 7.2           |                                      |
| Near Shelly Island                        | 14             | 1                   | 19990801      | 1.5              | 11.9            | 2.9              | 4                   | 4                              | 2                                  | 9.6           | 103                                  |
| Near Little Detroit                       | 14             | 1                   | 19990801      | 1.5              | 32.9            | 5.9              | 4                   | 4                              | 2                                  | 5.4           |                                      |
| <i>Fall</i>                               |                |                     |               |                  |                 |                  |                     |                                |                                    |               |                                      |
| Mouth of Spanish River                    | 14             | 1                   | 19991020      | 1.2              | 2.7             | 1.2              |                     |                                |                                    | 16.6          |                                      |
| Whalesback Channel                        | 14             | 1                   | 19991020      | 1.5              | 22.8            | 4.1              |                     |                                |                                    | 8.0           | 182                                  |
| Whalesback Channel (near Greenway Island) | 14             | 1                   | 19991020      | 1.5              | 13.8            | 4.0              |                     |                                |                                    | 7.8           |                                      |
| Ard Bay                                   | 14             | 1                   | 19991020      | 1.5              | 8.2             | 2.3              |                     |                                |                                    | 8.0           |                                      |
| Near Shelly Island                        | 14             | 1                   | 19991020      | 1.5              | 11.7            | 3.0              |                     |                                |                                    | 10.4          |                                      |
| Near Little Detroit                       | 14             | 1                   | 19991020      | 1.5              | 30.2            | 6.0              |                     |                                |                                    | 5.4           |                                      |
| <b>Nipigon Bay</b>                        |                |                     |               |                  |                 |                  |                     |                                |                                    |               |                                      |
| <i>Spring</i>                             |                |                     |               |                  |                 |                  |                     |                                |                                    |               |                                      |
| Downstream of Nipigon R                   | 1              | 1                   | 19990522      | 1.5              | 28.8            | 1.1              |                     |                                |                                    | 0.2 $\leq$ 1W |                                      |
| Nipigon Bay - 30 m S of mill outfall      | 1              | 1                   | 19990522      | 0.5              | 2.2             | 0.8              |                     |                                |                                    | 2.0           |                                      |
| Nipigon Bay - NW of Five Mile Pt          | 1              | 1                   | 19990522      | 1.5              | 20.9            | 1.5              |                     |                                |                                    | 0.8 $\leq$ 1T | 116                                  |
| Nipigon Bay - West of Frog Island         | 1              | 1                   | 19990522      | 1.5              | 30.5            | 1.5              |                     |                                |                                    | 1.2           |                                      |
| 500 m south of mill outfall               | 1              | 1                   | 19990522      | 1.5              | 2.8             | 1.2              |                     |                                |                                    | 2.6           |                                      |
| 500 m south of mill outfall               | 1              | 1                   | 19990522      | 1.5              | 2.8             | 1.2              |                     |                                |                                    | 1.8           |                                      |
| <i>Summer</i>                             |                |                     |               |                  |                 |                  |                     |                                |                                    |               |                                      |
| Downstream of Nipigon R                   | 1              | 1                   | 19990801      | 1.5              | 28.2            | 2.3              |                     |                                |                                    | 1.2           |                                      |
| Nipigon Bay - 30 m S of mill outfall      | 1              | 1                   | 19990801      | 0.5              | 3.5             | 1.2              |                     |                                |                                    | 1.4           |                                      |
| Nipigon Bay - NW of Five Mile Pt          | 1              | 1                   | 19990801      | 1.5              | 21.2            | 2.3              |                     |                                |                                    | 1.0           |                                      |
| Nipigon Bay - West of Frog Island         | 1              | 1                   | 19990731      | 1.5              | 3.0             | 2.1              |                     |                                |                                    | 1.2           |                                      |
| 500 m south of mill outfall               | 1              | 1                   | 19990801      | 1.5              | 3.0             | 2.0              |                     |                                |                                    | 1.4           | 131                                  |
| <i>Fall</i>                               |                |                     |               |                  |                 |                  |                     |                                |                                    |               |                                      |
| Downstream of Nipigon R                   | 1              | 1                   | 19991011      | 1.5              | 28.8            | 2.6              |                     |                                |                                    | 1.0           |                                      |
| Nipigon Bay - 30 m S of mill outfall      | 1              | 1                   | 19991011      | 0.5              | 2.1             | 1.5              |                     |                                |                                    | 1.4           |                                      |
| Nipigon Bay - NW of Five Mile Pt          | 1              | 1                   | 19991011      | 1.5              | 21.5            | 1.6              |                     |                                |                                    | 1.2           |                                      |
| Nipigon Bay - West of Frog Island         | 1              | 1                   | 19991011      | 1.5              | 30.3            | 1.1              |                     |                                |                                    | 1.2           |                                      |
| 500 m south of mill outfall               | 1              | 1                   | 19991011      | 1.4              | 0.3             | 1.1              |                     |                                |                                    | 1.2           |                                      |
| 500 m south of mill outfall               | 1              | 1                   | 19991011      | 0.6              | 0.0             | 1.1              |                     |                                |                                    | 1.4           |                                      |



Table1: Nutrient concentrations and other water quality parameters for samples collected from Lake Superior and the Spanish River, 1999

| Station Description                | Station number | Field Sample number | Date YYYYMMDD | Sample Water Depth (m) | Seach Depth (m) | E coli count/100mL | Fecal Streptococci count/100mL | Pseudomonas aeruginosa count/100mL | Chloride mg/L | Conductivity (field) $\mu$ S/cm 25 C |
|------------------------------------|----------------|---------------------|---------------|------------------------|-----------------|--------------------|--------------------------------|------------------------------------|---------------|--------------------------------------|
| <b>Jackfish Bay</b>                |                |                     |               |                        |                 |                    |                                |                                    |               |                                      |
| Spring                             |                |                     |               |                        |                 |                    |                                |                                    |               |                                      |
| Blackbird Creek - mouth            | 11             | 701 GL970190        | 19990520      | 0.5                    | 1.6             | 10 <               | 80 <=                          | 4 <                                | 58.0          | 469                                  |
| Blackbird Creek - mouth            | 11             | 701 GL970421        | 19990520      | 0.7                    | 1.4             | 2                  | 2 <                            | 0                                  |               |                                      |
| Moberly Bay                        | 11             | 702 GL970158        | 19990520      | 0.5                    | 18.8            | 2                  | 2 <                            | 0                                  |               |                                      |
| Moberly Bay                        | 11             | 702 GL970159        | 19990520      | 0.5                    | 18.8            | 2 <                | 2                              | 0                                  |               |                                      |
| Moberly Bay                        | 11             | 702 GL970410        | 19990520      | 1.5                    | 18.8            | 2                  | 2 <                            | 0                                  |               |                                      |
| Moberly Bay                        | 11             | 702 GL970420        | 19990520      | 1.5                    | 18.8            | 2                  | 2 <                            | 0                                  |               |                                      |
| Downstream of Moberly Bay          | 11             | 702 GL970157        | 19990520      | 0.5                    | 27.1            | 2 <                | 2 <                            | 0                                  |               |                                      |
| Downstream of Moberly Bay          | 11             | 710 GL970415        | 19990520      | 0.5                    | 27.8            | 2 <                | 2 <                            | 0                                  |               |                                      |
| Jackfish Bay                       | 11             | 451 GL970159        | 19990520      | 0.5                    | 41.3            | 2 <                | 2 <                            | 0                                  |               |                                      |
| Jackfish Bay                       | 11             | 451 GL970417        | 19990520      | 1.5                    | 41.3            | 2 <                | 2 <                            | 0                                  |               |                                      |
| Near Tenance Bay at Kimberly Clark | 11             | 452 GL970192        | 19990520      | 0.5                    | 20.0            | 2 <                | 2 <                            | 0                                  |               |                                      |
| Near Tenance Bay at Kimberly Clark | 11             | 452 GL970423        | 19990520      | 1.5                    | 27.9            | 2 <                | 2 <                            | 0                                  |               |                                      |
| Summer                             |                |                     |               |                        |                 |                    |                                |                                    |               |                                      |
| Blackbird Creek - mouth            | 11             | 701 GL970428        | 19990802      | 0.8                    | 1.8             | 0.1                | 4 <                            | 16                                 | 166.0         |                                      |
| Moberly Bay                        | 11             | 702 GL970428        | 19990802      | 1.5                    | 18.3            | 1.5                | 4 <                            | 24                                 | 13.6          |                                      |
| Downstream of Moberly Bay          | 11             | 710 GL970427        | 19990802      | 1.5                    | 34.7            | 2                  | 4 <                            | 2 <                                | 4.4           | 11.4                                 |
| Jackfish Bay                       | 11             | 451 GL970426        | 19990802      | 1.5                    | 40.7            | 3.0                | 4 <                            | 2 <                                | 3.8           |                                      |
| Near Tenance Bay at Kimberly Clark | 11             | 452 GL970424        | 19990802      | 1.5                    | 27.0            | 9.5                | 4 <                            | 2 <                                | 1.4           |                                      |
| Near Tenance Bay at Kimberly Clark | 11             | 452 GL970425        | 19990802      | 1.5                    | 27.0            | 9.5                | 4 <                            | 2 <                                | 1.4           |                                      |
| Fall                               |                |                     |               |                        |                 |                    |                                |                                    |               |                                      |
| Blackbird Creek - mouth            | 11             | 701 GL954028        | 19991013      | 0.5                    | 2.2             | 1.0                |                                |                                    | 16.8          |                                      |
| Blackbird Creek - mouth            | 11             | 701 GL954029        | 19991013      | 0.5                    | 2.2             | 1.0                |                                |                                    | 18.8          |                                      |
| Moberly Bay                        | 11             | 702 GL954027        | 19991013      | 1.5                    | 18.4            | 2.1                |                                |                                    | 3.6           | 110                                  |
| Downstream of Moberly Bay          | 11             | 710 GL954026        | 19991013      | 1.5                    | 24.6            | 7.0                |                                |                                    | 1.8           |                                      |
| Jackfish Bay                       | 11             | 451 GL954025        | 19991013      | 1.5                    | 41.0            | 7.5                |                                |                                    | 1.6           |                                      |
| Near Tenance Bay at Kimberly Clark | 11             | 452 GL954024        | 19991013      | 1.5                    | 23.5            | 8.8                |                                |                                    | 1.6           |                                      |
| <b>Pic River</b>                   |                |                     |               |                        |                 |                    |                                |                                    |               |                                      |
| Spring                             |                |                     |               |                        |                 |                    |                                |                                    |               |                                      |
| Pic River                          | 11             | 20 GL970148         | 19990519      | 0.5                    | 11.0            | 2 <                | 2 <                            | 0                                  |               |                                      |
| Pic River                          | 11             | 20 GL970410         | 19990519      | 1.5                    | 11.0            | 5.0                |                                |                                    | 1.0           |                                      |
| Pic River                          | 11             | 20 GL970411         | 19990519      | 1.5                    | 11.0            | 5.0                |                                |                                    | 1.0           |                                      |
| Pic River - South of mouth         | 11             | 454 GL970150        | 19990519      | 0.5                    | 3.5             | 2                  | 4                              | 0                                  |               |                                      |
| Pic River - South of mouth         | 11             | 454 GL970413        | 19990519      | 1.5                    | 3.3             | 0.8                |                                |                                    | 0.6 <         |                                      |
| Pic River - west of mouth          | 11             | 457 GL970149        | 19990519      | 0.5                    | 1.7             | 289                | 720                            | 20 <                               |               |                                      |
| Pic River - west of mouth          | 11             | 457 GL970412        | 19990519      | 1.0                    | 2.3             | 0.0                |                                |                                    |               | 15.8                                 |
| North of Pic R. by Hezon Bay       | 11             | 21 GL970151         | 19990519      | 0.5                    | 20.5            | 2 <                | 2                              | 0                                  |               |                                      |
| North of Pic R. by Hezon Bay       | 11             | 21 GL970414         | 19990519      | 1.0                    | 20.3            | 7.5                |                                |                                    | 1.0           |                                      |
| Summer                             |                |                     |               |                        |                 |                    |                                |                                    |               |                                      |
| Pic River                          | 11             | 20 GL970444         | 19990805      | 1.5                    | 11.2            | 3.0                | 4 <                            | 4 <                                | 1.4           |                                      |
| Pic River - mouth                  | 11             | 453 GL970445        | 19990805      | 1.5                    | 11.6            | 0.8                | 8                              | 2 <                                | 1.4           |                                      |
| Pic River - mouth                  | 11             | 453 GL970446        | 19990805      | 1.5                    | 11.6            | 0.8                | 4 <                            | 4 <                                | 2.4           |                                      |
| North of Pic R. by Hezon Bay       | 11             | 21 GL970443         | 19990805      | 1.5                    | 28.3            | 9.0                | 4 <                            | 4 <                                | 1.6           |                                      |
| Fall                               |                |                     |               |                        |                 |                    |                                |                                    |               |                                      |
| Pic River                          | 11             | 20 GL954037         | 19991015      | 1.5                    | 11.2            | 8.3                |                                |                                    | 1.4           |                                      |
| Pic River                          | 11             | 20 GL954038         | 19991015      | 1.5                    | 11.2            | 8.3                |                                |                                    | 1.4           |                                      |
| Pic River - mouth                  | 11             | 453 GL954039        | 19991015      | 1.5                    | 13.1            | 0.5                |                                |                                    | 1.6           |                                      |
| Pic River - South of mouth         | 11             | 454 GL954040        | 19991015      | 1.0                    | 2.0             | 1.0                |                                |                                    | 1.6           |                                      |
| Pic River - west of mouth          | 11             | 457 GL954041        | 19991015      | 1.0                    | 2.1             | 0.6                |                                |                                    | 1.6           |                                      |
| North of Pic R. by Hezon Bay       | 11             | 21 GL954036         | 19991015      | 1.5                    | 20.5            | 7.1                |                                |                                    | 1.4           |                                      |

<1 measurable trace amount Interpret with caution

<= approximate value

14 - split sample

11 - surface grab sample



Table1: Nutrient concentrations and other water quality parameters for samples collected from Lake Superior and the Spanish River, 1999

| Station Description                       | Station number | Field Sample number | Date YYYYMMDD | Ammonia ammonium mg/L | Nitrite mg/L | Nitrate mg/L | Total Inorganic Nitrogen | TN mg/L  | Total Organic Nitrogen | pH (field) | Total Phosphorus mg/L | Suspended Solids mg/L |
|---|----------------|---------------------|---------------|-----------------------|--------------|--------------|--------------------------|----------|------------------------|------------|-----------------------|-----------------------|
| <b>Spanish River</b>                      |                |                     |               |                       |              |              |                          |          |                        |            |                       |                       |
| <i>Spring</i>                             |                |                     |               |                       |              |              |                          |          |                        |            |                       |                       |
| Mouth of Spanish River                    | 14             | 1                   | 1999/05/12    | 0.022                 | 0.006        | 0.180        | 0.202                    | 0.800    | 0.578                  |            | 0.018                 | 3.0                   |
| Whalesback Channel                        | 14             | 1                   | 1999/05/12    | 0.018                 | 0.005        | 0.240        | 0.256                    | 0.220    | 0.204                  |            | 0.008 <T              | 2.0 <T                |
| Whalesback Channel (near Greenway Island) | 14             | 1                   | 1999/05/12    | 0.022                 | 0.004 <T     | 0.255        | 0.277                    | 0.240    | 0.218                  |            | 0.008 <T              | 2.0 <T                |
| Ard Bay                                   | 14             | 1                   | 1999/05/12    | 0.018                 | 0.005        | 0.250        | 0.268                    | 0.240    | 0.222                  |            | 0.008 <T              | 4.0                   |
| Ard Bay                                   | 14             | 1                   | 1999/05/12    | 0.018                 | 0.005        | 0.250        | 0.268                    | 0.240    | 0.222                  |            | 0.008 <T              | 2.0 <T                |
| Near Shanty Island                        | 14             | 1                   | 1999/05/12    | 0.012                 | 0.006        | 0.240        | 0.252                    | 0.200    | 0.184                  |            | 0.006 <T              | 2.0 <T                |
| Near Shanty Island                        | 14             | 1                   | 1999/05/12    | 0.002 <W              | 0.002 <T     | 0.255        | 0.257                    | 0.090 <T | 0.078                  |            | 0.002 <SW             | 1.5 <T                |
| <i>Summer</i>                             |                |                     |               |                       |              |              |                          |          |                        |            |                       |                       |
| Mouth of Spanish River                    | 14             | 1                   | 1999/09/10    | 0.008 <T              | 0.006        | 0.075        | 0.093                    | 0.320    | 0.312                  |            | 0.010                 | 11.5                  |
| Whalesback Channel                        | 14             | 1                   | 1999/09/10    | 0.008 <T              | 0.004 <T     | 0.135        | 0.143                    | 0.200    | 0.192                  |            | 0.008 <T              | 2.0 <T                |
| Whalesback Channel                        | 14             | 1                   | 1999/09/10    | 0.008 <T              | 0.008 <T     | 0.140        | 0.146                    | 0.160    | 0.172                  |            | 0.006 <T              | 2.0 <T                |
| Whalesback Channel (near Greenway Island) | 14             | 1                   | 1999/09/10    | 0.008 <T              | 0.004 <T     | 0.155        | 0.161                    | 0.200    | 0.194                  |            | 0.004 <T              | 5.0                   |
| Ard Bay                                   | 14             | 1                   | 1999/09/10    | 0.008 <T              | 0.003 <T     | 0.125        | 0.131                    | 0.180    | 0.172                  |            | 0.004 <T              | 2.0 <T                |
| Near Shanty Island                        | 14             | 1                   | 1999/09/10    | 0.018                 | 0.003 <T     | 0.095        | 0.113                    | 0.200    | 0.182                  | 7.83       | 0.016                 | 2.5                   |
| Near Shanty Island                        | 14             | 1                   | 1999/09/10    | 0.008 <T              | 0.002 <T     | 0.185        | 0.193                    | 0.120    | 0.112                  |            | 0.002 <SW             | 1.0 <T                |
| <i>Fall</i>                               |                |                     |               |                       |              |              |                          |          |                        |            |                       |                       |
| Mouth of Spanish River                    | 14             | 1                   | 1999/10/20    | 0.036                 | 0.004 <T     | 0.135        | 0.171                    | 0.360    | 0.324                  |            | 0.024                 | 8.0                   |
| Whalesback Channel                        | 14             | 1                   | 1999/10/20    | 0.044                 | 0.008        | 0.303        | 0.347                    | 0.220    | 0.156                  | 7.71       | 0.012                 | 3.0                   |
| Whalesback Channel                        | 14             | 1                   | 1999/10/20    | 0.018                 | 0.001 <SW    | 0.191        | 0.209                    | 0.200    | 0.192                  |            | 0.012                 | 2.0 <T                |
| Ard Bay                                   | 14             | 1                   | 1999/10/20    | 0.020                 | 0.001 <SW    | 0.180        | 0.200                    | 0.220    | 0.200                  |            | 0.008 <T              | 2.5                   |
| Near Shanty Island                        | 14             | 1                   | 1999/10/20    | 0.018                 | 0.001 <SW    | 0.158        | 0.176                    | 0.160    | 0.192                  |            | 0.012                 | 2.0 <T                |
| Near Shanty Island                        | 14             | 1                   | 1999/10/20    | 0.038                 | 0.001 <SW    | 0.157        | 0.193                    | 0.240    | 0.204                  |            | 0.012                 | 5.0                   |
| Near Little Detroit                       | 14             | 1                   | 1999/10/20    | 0.004 <T              | 0.001 <SW    | 0.255        | 0.259                    | 0.260    | 0.216                  |            | 0.012                 | 0.5 <T                |
| <b>Nipigon Bay</b>                        |                |                     |               |                       |              |              |                          |          |                        |            |                       |                       |
| <i>Spring</i>                             |                |                     |               |                       |              |              |                          |          |                        |            |                       |                       |
| Downstream of Nipigon R                   | 1              | 1                   | 1999/05/22    | 0.002 <SW             | 0.001 <SW    | 0.045        | 0.037                    | 0.080 <T | 0.036                  |            | 0.004 <T              | 7.0                   |
| Nipigon Bay - 30 m S of mill outfall      | 1              | 1                   | 1999/05/22    | 0.012                 | 0.012        | 0.125        | 0.137                    | 0.360    | 0.278                  |            | 0.008                 | 5.0                   |
| Nipigon Bay - NW of Five Mile Pt          | 1              | 1                   | 1999/05/22    | 0.002 <SW             | 0.001 <SW    | 0.210        | 0.210                    | 0.360    | 0.198                  | 7.89       | 0.008 <T              | 4.0                   |
| Nipigon Bay - West of Frog Island         | 1              | 1                   | 1999/05/22    | 0.002 <SW             | 0.001 <SW    | 0.165        | 0.165                    | 0.300    | 0.198                  |            | 0.008 <T              | 5.0                   |
| 500 m south of mill outfall               | 1              | 1                   | 1999/05/22    | 0.004 <T              | 0.001        | 0.165        | 0.169                    | 0.300    | 0.266                  |            | 0.032                 | 5.0                   |
| 500 m south of mill outfall               | 1              | 1                   | 1999/05/22    | 0.004 <T              | 0.007        | 0.185        | 0.189                    | 0.260    | 0.266                  |            | 0.024                 | 5.0                   |
| <i>Summer</i>                             |                |                     |               |                       |              |              |                          |          |                        |            |                       |                       |
| Downstream of Nipigon R                   | 1              | 1                   | 1999/08/01    | 0.002 <SW             | 0.003 <T     | 0.120        | 0.122                    | 0.200    | 0.198                  |            | 0.004 <T              | 3.0                   |
| Nipigon Bay - 30 m S of mill outfall      | 1              | 1                   | 1999/08/01    | 0.002 <SW             | 0.003 <T     | 0.070        | 0.072                    | 0.220    | 0.218                  |            | 0.010                 | 5.0                   |
| Nipigon Bay - NW of Five Mile Pt          | 1              | 1                   | 1999/08/01    | 0.003 <SW             | 0.003 <T     | 0.070        | 0.072                    | 0.220    | 0.218                  |            | 0.012                 | 5.0                   |
| Nipigon Bay - West of Frog Island         | 1              | 1                   | 1999/08/01    | 0.002 <SW             | 0.002 <T     | 0.100        | 0.102                    | 0.160    | 0.178                  |            | 0.006 <T              | 2.5 <T                |
| Nipigon Bay - West of Frog Island         | 1              | 1                   | 1999/07/31    | 0.002 <SW             | 0.003 <T     | 0.120        | 0.122                    | 0.160    | 0.158                  |            | 0.004 <T              | 2.5                   |
| 500 m south of mill outfall               | 1              | 1                   | 1999/08/01    | 0.002 <SW             | 0.003 <T     | 0.105        | 0.107                    | 0.240    | 0.238                  | 6.01       | 0.004 <T              | 2.5                   |
| <i>Fall</i>                               |                |                     |               |                       |              |              |                          |          |                        |            |                       |                       |
| Downstream of Nipigon R                   | 1              | 1                   | 1999/10/11    | 0.004 <T              | 0.002 <T     | 0.047        | 0.051                    | 0.180    | 0.178                  |            | 0.006 <T              | 3.0                   |
| Nipigon Bay - 30 m S of mill outfall      | 1              | 1                   | 1999/10/11    | 0.004 <T              | 0.001 <SW    | 0.138        | 0.142                    | 0.180    | 0.178                  |            | 0.006 <T              | 4.5                   |
| Nipigon Bay - NW of Five Mile Pt          | 1              | 1                   | 1999/10/11    | 0.008 <T              | 0.003 <T     | 0.160        | 0.168                    | 0.160    | 0.152                  |            | 0.006 <T              | 4.5                   |
| Nipigon Bay - West of Frog Island         | 1              | 1                   | 1999/10/11    | 0.008 <T              | 0.004 <T     | 0.193        | 0.201                    | 0.180    | 0.172                  |            | 0.020                 | 4.0                   |
| Nipigon Bay - West of Frog Island         | 1              | 1                   | 1999/10/11    | 0.004 <T              | 0.002 <T     | 0.147        | 0.151                    | 0.180    | 0.176                  |            | 0.008 <T              | 3.5                   |
| 500 m south of mill outfall               | 1              | 1                   | 1999/10/11    | 0.006 <T              | 0.002 <T     | 0.148        | 0.154                    | 0.200    | 0.194                  |            | 0.012                 | 4.0                   |



Table1: Nutrient concentrations and other water quality parameters for samples collected from Lake Superior and the Spanish River, 1999

| Station Description                 | Station number | Field Sample number | Date YYYYMMDD | Ammonia/ ammonium mg/L | Nitrite mg/L | Nitrite/Nitrate mg/L | Total Inorganic Nitrogen | TKN mg/L | Total Organic Nitrogen | pH (Field) | Total Phosphorus mg/L | Suspended Solids mg/L | RMK |
|-------------------------------------|----------------|---------------------|---------------|------------------------|--------------|----------------------|--------------------------|----------|------------------------|------------|-----------------------|-----------------------|-----|
| <b>Jackfish Bay</b>                 |                |                     |               |                        |              |                      |                          |          |                        |            |                       |                       |     |
| <i>Spring</i>                       |                |                     |               |                        |              |                      |                          |          |                        |            |                       |                       |     |
| Blackbird Creek - mouth             | 1              | 701 GL976160        | 11 1999/05/20 | 0.222                  | 0.099        | 0.810                | 1.032                    | 1.040    | 0.618                  | 7.51       | 0.144                 | 9.0                   |     |
| Blackbird Creek - mouth             | 1              | 701 GL976421        | 11 1999/05/20 |                        |              |                      |                          |          |                        |            |                       |                       |     |
| McKenry Bay                         | 1              | 702 GL976158        | 14 1999/05/20 |                        |              |                      |                          |          |                        |            |                       |                       |     |
| McKenry Bay                         | 1              | 702 GL976159        | 14 1999/05/20 | 0.034                  | 0.010        | 0.375                | 0.408                    | 0.240    | 0.206                  | 0.018      | 0.018                 | 1.5 <T                |     |
| McKenry Bay                         | 1              | 702 GL976419        | 14 1999/05/20 | 0.040                  | 0.012        | 0.385                | 0.425                    | 0.230    | 0.240                  | 0.018      | 0.018                 | 1.5 <T                |     |
| Downstream of McKenry Bay           | 1              | 702 GL976420        | 14 1999/05/20 | 0.002 <=W              | 0.003 <=W    | 0.355                | 0.357                    | 0.140    | 0.139                  | 0.004 <T   | 0.004 <T              | 3.5                   |     |
| Downstream of McKenry Bay           | 1              | 710 GL976157        | 11 1999/05/20 |                        |              |                      |                          |          |                        |            |                       |                       |     |
| Jackfish Bay                        | 1              | 451 GL976156        | 11 1999/05/20 | 0.002 <=W              | 0.003 <=W    | 0.350                | 0.352                    | 0.120    | 0.119                  | 0.004 <T   | 0.004 <T              | 0.5 <T                |     |
| Jackfish Bay                        | 1              | 451 GL976417        | 11 1999/05/20 | 0.002 <=W              | 0.003 <=W    | 0.345                | 0.347                    | 0.080 <T | 0.076                  | 0.002 <=W  | 0.002 <=W             | 1.0 <T                |     |
| Near Terrence Bay at Kimberly Clark | 1              | 452 GL976423        | 11 1999/05/20 | 0.002 <=W              | 0.003 <=W    | 0.465                | 1.645                    | 3.040    | 1.860                  | 0.440      | 0.440                 | 6.0                   |     |
| Blackbird Creek - mouth             | 1              | 701 GL977429        | 11 1999/06/02 | 1.160                  | 0.236        | 0.018                | 0.433                    | 0.340    | 0.242                  | 0.032      | 0.032                 | 0.5 <T                |     |
| Blackbird Creek - mouth             | 1              | 702 GL977428        | 11 1999/06/02 | 0.098                  | 0.018        | 0.335                | 0.338                    | 0.160    | 0.156                  | 0.012      | 0.012                 | 0.5 <W                |     |
| Downstream of McKenry Bay           | 1              | 710 GL977427        | 11 1999/06/02 | 0.024                  | 0.006        | 0.310                | 0.312                    | 0.160    | 0.144                  | 0.012      | 0.012                 | 1.0 <T                |     |
| Jackfish Bay                        | 1              | 451 GL977426        | 11 1999/06/02 | 0.016                  | 0.006        | 0.310                | 0.312                    | 0.160    | 0.144                  | 0.012      | 0.012                 | 0.5 <T                |     |
| Near Terrence Bay at Kimberly Clark | 1              | 452 GL977424        | 14 1999/06/02 | 0.002 <=W              | 0.003 <T     | 0.310                | 0.312                    | 0.000 <T | 0.098                  | 0.006 <T   | 0.006 <T              | 0.5 <T                |     |
| Near Terrence Bay at Kimberly Clark | 1              | 452 GL977425        | 14 1999/06/02 | 0.004 <T               | 0.003 <T     | 0.310                | 0.314                    | 0.060 <T | 0.076                  | 0.004 <T   | 0.004 <T              | 0.5 <T                |     |
| Jackfish Bay                        | 1              | 451 GL954026        | 11 1999/10/13 | 0.002 <=W              | 0.003 <T     | 0.335                | 0.343                    | 0.120    | 0.112                  | 0.008 <T   | 0.008 <T              | 0.5 <T                |     |
| Blackbird Creek - mouth             | 1              | 701 GL954028        | 14 1999/10/13 | 0.056                  | 0.017        | 0.364                | 0.400                    | 0.360    | 0.304                  | 0.026      | 0.026                 | 3.0                   |     |
| Blackbird Creek - mouth             | 1              | 701 GL954029        | 14 1999/10/13 | 0.102                  | 0.032        | 0.423                | 0.525                    | 0.360    | 0.278                  | 0.028      | 0.028                 | 4.0                   |     |
| McKenry Bay                         | 1              | 702 GL954027        | 11 1999/10/13 | 0.016                  | 0.008        | 0.400                | 0.398                    | 0.200    | 0.184                  | 0.012      | 0.012                 | 3.0                   |     |
| Downstream of McKenry Bay           | 1              | 710 GL954028        | 11 1999/10/13 | 0.004 <T               | 0.003 <T     | 0.328                | 0.330                    | 0.120    | 0.115                  | 0.008 <T   | 0.008 <T              | 1.0 <T                |     |
| Jackfish Bay                        | 1              | 451 GL954025        | 11 1999/10/13 | 0.002 <=W              | 0.003 <T     | 0.328                | 0.330                    | 0.120    | 0.118                  | 0.008 <T   | 0.008 <T              | 0.5 <T                |     |
| Near Terrence Bay at Kimberly Clark | 1              | 452 GL954024        | 11 1999/10/13 | 0.008 <T               | 0.003 <T     | 0.335                | 0.343                    | 0.120    | 0.112                  | 0.008 <T   | 0.008 <T              | 0.5 <T                |     |
| <b>Pic River</b>                    |                |                     |               |                        |              |                      |                          |          |                        |            |                       |                       |     |
| <i>Spring</i>                       |                |                     |               |                        |              |                      |                          |          |                        |            |                       |                       |     |
| Pic River                           | 1              | 20 GL976146         | 11 1999/05/19 | 0.002 <=W              | 0.003 <=W    | 0.345                | 0.347                    | 0.120    | 0.118                  | 0.004 <T   | 0.004 <T              | 1.0 <T                |     |
| Pic River                           | 1              | 20 GL976410         | 14 1999/05/19 | 0.002 <=W              | 0.003 <=W    | 0.345                | 0.347                    | 0.120    | 0.118                  | 0.004 <T   | 0.004 <T              | 1.0 <T                |     |
| Pic River                           | 1              | 20 GL976411         | 14 1999/05/19 | 0.002 <=W              | 0.003 <=W    | 0.345                | 0.347                    | 0.120    | 0.118                  | 0.004 <T   | 0.004 <T              | 1.0 <T                |     |
| Pic River - South of mouth          | 1              | 454 GL976150        | 11 1999/05/19 | 0.002 <=W              | 0.003 <T     | 0.350                | 0.352                    | 0.160    | 0.158                  | 0.012      | 0.012                 | 7.5                   |     |
| Pic River - South of mouth          | 1              | 454 GL976413        | 11 1999/05/19 | 0.002 <=W              | 0.003 <T     | 0.350                | 0.352                    | 0.160    | 0.158                  | 0.012      | 0.012                 | 7.5                   |     |
| Pic River - west of mouth           | 1              | 457 GL976149        | 11 1999/05/19 | 0.002 <=W              | 0.003 <T     | 0.350                | 0.352                    | 0.160    | 0.158                  | 0.012      | 0.012                 | 7.5                   |     |
| Pic River - west of mouth           | 1              | 457 GL976412        | 11 1999/05/19 | 0.002 <=W              | 0.003 <T     | 0.350                | 0.352                    | 0.160    | 0.158                  | 0.012      | 0.012                 | 7.5                   |     |
| North of Pic R. by Heron Bay        | 1              | 21 GL976151         | 11 1999/05/19 | 0.002 <=W              | 0.003 <T     | 0.350                | 0.352                    | 0.160    | 0.158                  | 0.012      | 0.012                 | 7.5                   |     |
| North of Pic R. by Heron Bay        | 1              | 21 GL976414         | 11 1999/05/19 | 0.002 <=W              | 0.003 <T     | 0.350                | 0.352                    | 0.160    | 0.158                  | 0.012      | 0.012                 | 7.5                   |     |
| Summer                              | 1              | 20 GL977444         | 11 1999/06/05 | 0.002 <=W              | 0.003 <T     | 0.350                | 0.352                    | 0.160    | 0.158                  | 0.012      | 0.012                 | 7.5                   |     |
| Pic River - mouth                   | 1              | 453 GL977445        | 14 1999/06/05 | 0.002 <=W              | 0.004 <T     | 0.350                | 0.352                    | 0.160    | 0.158                  | 0.012      | 0.012                 | 7.5                   |     |
| Pic River - mouth                   | 1              | 453 GL977446        | 14 1999/06/05 | 0.002 <=W              | 0.004 <T     | 0.350                | 0.352                    | 0.160    | 0.158                  | 0.012      | 0.012                 | 7.5                   |     |
| North of Pic R. by Heron Bay        | 1              | 21 GL977443         | 11 1999/06/05 | 0.002 <=W              | 0.003 <T     | 0.350                | 0.352                    | 0.160    | 0.158                  | 0.012      | 0.012                 | 7.5                   |     |
| Jackfish Bay                        | 1              | 451 GL954037        | 11 1999/10/13 | 0.012                  | 0.003 <T     | 0.320                | 0.332                    | 0.080 <T | 0.068                  | 0.008 <T   | 0.008 <T              | 0.5 <W                |     |
| Pic River                           | 1              | 20 GL954038         | 14 1999/10/13 | 0.012                  | 0.003 <T     | 0.320                | 0.332                    | 0.080 <T | 0.068                  | 0.008 <T   | 0.008 <T              | 0.5 <W                |     |
| Pic River - mouth                   | 1              | 453 GL954039        | 11 1999/10/13 | 0.016                  | 0.005        | 0.123                | 0.138                    | 0.400    | 0.464                  | 0.020      | 0.020                 | 14.5                  |     |
| Pic River - South of mouth          | 1              | 453 GL954040        | 11 1999/10/13 | 0.016                  | 0.005        | 0.123                | 0.138                    | 0.400    | 0.464                  | 0.020      | 0.020                 | 14.5                  |     |
| Pic River - west of mouth           | 1              | 457 GL954041        | 11 1999/10/13 | 0.014                  | 0.005        | 0.132                | 0.146                    | 0.260    | 0.505                  | 0.020      | 0.020                 | 14.0                  |     |
| North of Pic R. by Heron Bay        | 1              | 21 GL954041         | 11 1999/10/13 | 0.008 <T               | 0.003 <T     | 0.318                | 0.326                    | 0.080 <T | 0.072                  | 0.002 <=W  | 0.002 <=W             | 1.0 <T                |     |

<W no measurable response  
 <T measurable trace amount. Interpret with caution  
 <= approximate value  
 14 - split sample  
 11 - surface grab sample







Table 1: Nutrient Concentrations and other water quality parameters for samples collected from Lake Superior and the Spanish River, 1999

| Station Description                   | Station number | Field number | Ammonia nitrogen mg/L | Nitrite mg/L | Nitrate mg/L | Total Inorganic Nitrogen mg/L | TP-N mg/L | Total Organic Nitrogen mg/L | Phosphate mg/L | Total Phosphate mg/L | Supernatant Solids mg/L | Phenol ug/L | RMS    |
|---------------------------------------|----------------|--------------|-----------------------|--------------|--------------|-------------------------------|-----------|-----------------------------|----------------|----------------------|-------------------------|-------------|--------|
| <b>Thunder Bay</b>                    |                |              |                       |              |              |                               |           |                             |                |                      |                         |             |        |
| Arm R. at Mission River               | 1              | 802          | 0.074537              | 0.008        | 0.010        | 0.173                         | 0.600     | 0.812                       | 0.043          | 0.072                | 14.0                    |             |        |
| Arm R. at Mission River               | 1              | 463          | 0.074538              | 0.070        | 0.012        | 0.105                         | 0.600     | 0.500                       | 0.044          | 0.072                | 14.5                    |             |        |
| Arm R. - mouth                        | 1              | 463          | 0.074538              | 0.064        | 0.008        | 0.270                         | 0.354     | 0.510                       | 0.006          | 0.032                | 6.5                     |             |        |
| Mission River - mouth                 | 1              | 176          | 0.074538              | 0.020        | 0.011        | 0.055                         | 0.680     | 0.610                       | 0.042          | 0.072                | 14.0                    |             | 0.8 <T |
| McKenzie River - mouth                | 1              | 462          | 0.074542              | 0.078        | 0.008        | 0.230                         | 0.308     | 0.520                       | 0.016          | 0.044                | 7.5                     |             |        |
| Mission River transect                | 1              | 564          | 0.074541              | 0.062        | 0.005        | 0.165                         | 0.217     | 0.520                       | 0.028          | 0.054                | 12.0                    |             |        |
| Sturgeon McKenzie & Ken River         | 1              | 572          | 0.074535              | 0.002        | <W           | 0.320                         | 0.322     | 0.158                       | 0.022          | <T                   | 0.006                   |             |        |
| North of Mission (subside drain bed)  | 1              | 464          | 0.074540              | 0.014        | 0.008        | 0.265                         | 0.279     | 0.400                       | 0.008          | 0.044                | 6.5                     |             |        |
| Provincial Paper (subside drain bed)  | 1              | 465          | 0.074540              | 0.008        | <T           | 0.215                         | 0.263     | 0.310                       | 0.002          | <T                   | 0.018                   |             |        |
| Old Ashby outlet (north of Bay Pt.)   | 1              | 466          | 0.074543              | 0.002        | <W           | 0.330                         | 0.332     | 0.110                       | 0.001          | <T                   | 0.004                   |             |        |
| North Entrance                        | 1              | 467          | 0.074544              | 0.002        | <W           | 0.310                         | 0.312     | 0.240                       | 0.001          | <T                   | 0.010                   |             |        |
| Transect                              | 1              | 802          | 0.074554              | 0.114        | 0.005        | 0.265                         | 0.310     | 0.460                       | 0.030          | 0.068                | 4.0                     |             |        |
| Arm R. at Mission River               | 1              | 463          | 0.074559              | 0.112        | 0.007        | 0.253                         | 0.467     | 0.150                       | 0.017          | 0.020                | 3.0                     |             |        |
| Arm R. - mouth                        | 1              | 463          | 0.074560              | 0.032        | 0.005        | 0.295                         | 0.469     | 0.350                       | 0.075          | 0.146                | 4.5                     |             |        |
| McKenzie River - mouth                | 1              | 176          | 0.074566              | 0.064        | 0.005        | 0.240                         | 0.306     | 0.148                       | 0.022          | 0.032                | 3.0                     |             |        |
| Mission River transect                | 1              | 564          | 0.074562              | 0.060        | <W           | 0.310                         | 0.312     | 0.200                       | 0.002          | <T                   | 0.018                   |             |        |
| Mission River transect                | 1              | 564          | 0.074563              | 0.002        | <W           | 0.295                         | 0.297     | 0.005                       | 0.002          | <T                   | 0.018                   |             |        |
| Sturgeon McKenzie & Ken River         | 1              | 572          | 0.074567              | 0.060        | 0.004        | <T                            | 0.300     | 0.250                       | 0.006          | 0.022                | 3.0                     |             |        |
| North of Mission (subside drain bed)  | 1              | 464          | 0.074567              | 0.002        | <W           | 0.310                         | 0.312     | 0.140                       | 0.002          | <T                   | 0.018                   |             |        |
| Provincial Paper (subside drain bed)  | 1              | 465          | 0.074571              | 0.138        | 0.005        | 0.195                         | 0.321     | 0.134                       | 0.009          | 0.024                | 5.5                     |             |        |
| Old Ashby outlet (north of Bay Pt.)   | 1              | 466          | 0.074574              | 0.008        | <T           | 0.280                         | 0.296     | 0.152                       | 0.002          | <T                   | 0.004                   |             |        |
| North Entrance                        | 1              | 467          | 0.074574              | 0.016        | 0.003        | 0.265                         | 0.274     | 0.224                       | 0.001          | <T                   | 0.010                   |             |        |
| Transect                              | 1              | 802          | 0.074585              | 0.005        | <T           | 0.183                         | 0.177     | 0.600                       | 0.592          | 0.034                | 0.046                   |             |        |
| Arm R. at Mission River               | 1              | 463          | 0.074588              | 0.440        | 0.007        | 0.253                         | 0.603     | 0.540                       | 0.021          | 0.054                | 4.5                     |             |        |
| Arm R. - mouth                        | 1              | 463          | 0.074589              | 0.038        | <T           | 0.178                         | 0.184     | 0.632                       | 0.038          | 0.046                | 17.5                    |             |        |
| McKenzie River - mouth                | 1              | 176          | 0.074590              | 0.008        | 0.006        | 0.178                         | 0.184     | 0.544                       | 0.048          | 0.046                | 10.0                    |             |        |
| Mission River transect                | 1              | 564          | 0.074591              | 0.016        | 0.006        | 0.178                         | 0.184     | 0.544                       | 0.048          | 0.046                | 10.0                    |             |        |
| Mission River transect                | 1              | 564          | 0.074591              | 0.018        | 0.008        | 0.178                         | 0.184     | 0.544                       | 0.048          | 0.046                | 10.0                    |             |        |
| Sturgeon McKenzie & Ken River         | 1              | 572          | 0.074597              | 0.092        | 0.003        | <T                            | 0.290     | 0.418                       | 0.160          | 0.008                | 0.012                   |             |        |
| North of Mission (subside drain bed)  | 1              | 464          | 0.074601              | 0.014        | 0.003        | <T                            | 0.313     | 0.300                       | 0.268          | 0.011                | 4.0                     |             |        |
| Provincial Paper (subside drain bed)  | 1              | 465          | 0.074601              | 0.044        | 0.002        | <T                            | 0.350     | 0.240                       | 0.198          | 0.008                | 0.024                   |             |        |
| Old Ashby outlet (north of Bay Pt.)   | 1              | 466          | 0.074601              | 0.008        | <T           | 0.332                         | 0.332     | 0.110                       | 0.004          | 0.004                | <T                      |             |        |
| North Entrance                        | 1              | 467          | 0.074610              | 0.072        | 0.002        | 0.312                         | 0.258     | 0.150                       | 0.001          | 0.018                | 2.0                     |             |        |
| <b>Peninsula Harbour</b>              |                |              |                       |              |              |                               |           |                             |                |                      |                         |             |        |
| Jefferson Cove - Near wharf           | 1              | 275          | 0.074601              | 0.002        | <W           | 0.350                         | 0.352     | 0.040                       | <T             | 0.004                | <T                      | 0.5         |        |
| Jefferson Cove - Near wharf           | 1              | 275          | 0.074612              |              |              |                               |           |                             |                |                      |                         |             |        |
| Jefferson Cove - Near wharf           | 1              | 275          | 0.074614              |              |              |                               |           |                             |                |                      |                         |             |        |
| Jefferson Cove - Near wharf           | 1              | 275          | 0.074615              |              |              |                               |           |                             |                |                      |                         |             |        |
| Jefferson Cove - Near wharf           | 1              | 275          | 0.074622              | 0.002        | <W           | 0.350                         | 0.352     | 0.040                       | <T             | 0.002                | <W                      | 1.0         |        |
| Marathon Bay - Near wharf             | 1              | 279          | 0.074603              | 0.002        | <W           | 0.345                         | 0.352     | 0.058                       | 0.001          | <W                   | 0.002                   |             |        |
| Marathon Bay - New mill discharge pt. | 1              | 470          | 0.074604              | 0.002        | <W           | 0.345                         | 0.347     | 0.100                       | 0.058          | 0.001                | <W                      | 1.0         |        |
| Marathon Bay - New mill discharge pt. | 1              | 470          | 0.074617              |              |              |                               |           |                             |                |                      |                         |             |        |
| Upstream - new mill discharge pt.     | 1              | 471          | 0.074605              | 0.002        | <W           | 0.350                         | 0.352     | 0.200                       | 0.001          | <T                   | 0.004                   |             |        |
| Upstream - new mill discharge pt.     | 1              | 471          | 0.074616              |              |              |                               |           |                             |                |                      |                         |             |        |
| 500 m south of S.P.                   | 1              | 469          | 0.074609              | 0.002        | <W           | 0.35                          | 0.352     | 0.120                       | 0.118          | 0.004                | <T                      | 0.5         |        |
| Transect                              | 1              | 275          | 0.074627              | 0.002        | <W           | 0.305                         | 0.307     | 0.100                       | 0.098          | 0.002                | <T                      | 0.004       |        |
| Jefferson Cove - Near wharf           | 1              | 275          | 0.074638              | 0.002        | <W           | 0.305                         | 0.302     | 0.080                       | <T             | 0.018                | 0.004                   |             |        |
| Jefferson Cove - Near wharf           | 1              | 275          | 0.074639              | 0.002        | <W           | 0.310                         | 0.312     | 0.170                       | 0.018          | 0.001                | <W                      | 0.004       |        |
| Marathon Bay - Near wharf             | 1              | 279          | 0.074639              | 0.002        | <W           | 0.310                         | 0.312     | 0.170                       | 0.018          | 0.001                | <W                      | 0.004       |        |
| Upstream - new mill discharge pt.     | 1              | 471          | 0.074624              | 0.005        | <T           | 0.295                         | 0.301     | 0.020                       | <W             | 0.014                | 0.001                   |             |        |
| 500 m south of S.P.                   | 1              | 469          | 0.074625              | 0.004        | <T           | 0.335                         | 0.337     | 0.060                       | <T             | 0.018                | 0.001                   |             |        |
| Transect                              | 1              | 275          | 0.074635              | 0.004        | <T           | 0.305                         | 0.307     | 0.080                       | <T             | 0.018                | 0.001                   |             |        |
| Jefferson Cove - Near wharf           | 1              | 275          | 0.074642              | 0.010        | 0.004        | <T                            | 0.318     | 0.106                       | 0.060          | 0.003                | 0.004                   |             |        |
| Jefferson Cove - Near wharf           | 1              | 279          | 0.074643              | 0.008        | <T           | 0.311                         | 0.316     | 0.100                       | 0.062          | 0.002                | <T                      | 0.004       |        |
| Marathon Bay - Near wharf             | 1              | 279          | 0.074644              | 0.005        | <T           | 0.308                         | 0.315     | 0.160                       | 0.154          | 0.002                | <T                      | 0.012       |        |
| Marathon Bay - New mill discharge pt. | 1              | 470          | 0.074605              | 0.012        | 0.003        | <T                            | 0.327     | 0.160                       | 0.146          | 0.001                | <T                      | 0.010       |        |
| Upstream - new mill discharge pt.     | 1              | 471          | 0.074604              | 0.008        | <T           | 0.321                         | 0.328     | 0.140                       | 0.132          | 0.001                | <T                      | 0.012       |        |
| 500 m south of S.P.                   | 1              | 469          | 0.074603              | 0.005        | <T           | 0.318                         | 0.324     | 0.120                       | 0.112          | 0.004                | <T                      | 1           |        |

<W = measurable response

<T = measurable trace amount

<W = approximate value

<W = surficial sample

14 = split sample

11 = surface grab sample



Table 2: Metal concentrations in water collected from Lake Superior and the Spanish River, 1999

| Station Description                     | Station number | Field Sample number | Date YYYYMMDD | Aluminum ug/L   | Iron ug/L | Barium ug/L    | Beryllium ug/L   | Cadmium ug/L    | Cobalt ug/L     | Chromium ug/L  |
|---|----------------|---------------------|---------------|-----------------|-----------|----------------|------------------|-----------------|-----------------|----------------|
| <b>Spanish River</b>                    |                |                     |               |                 |           |                |                  |                 |                 |                |
| <i>Spring</i>                           |                |                     |               |                 |           |                |                  |                 |                 |                |
| Mouth of Spanish River                  | 14             | 400 GL179481        | 11/1999/05/12 | 51.9 +/- 11.000 | 0.0005 +w | 14.6 +/- 0.940 | -0.002 +/- 1.000 | 0.032 +/- 0.500 | 0.301 +/- 1.000 | 1.86 +/- 5.000 |
| Wakabuck Channel                        | 14             | 401 GL179482        | 11/1999/05/12 | 22.4 +/- 11.000 | 0.0005 +w | 12.3 +/- 0.930 | -0.020 +/- 1.000 | 0.051 +/- 0.500 | 0.206 +/- 1.000 | 1.79 +/- 5.000 |
| Wakabuck Channel (near Greenway Island) | 14             | 209 GL179483        | 11/1999/05/12 | 31.2 +/- 11.000 | 0.0005 +w | 12.3 +/- 0.930 | -0.009 +/- 1.000 | 0.044 +/- 0.500 | 0.185 +/- 1.000 | 1.85 +/- 5.000 |
| And Bay                                 | 14             | 402 GL179484        | 11/1999/05/12 | 31.2 +/- 11.000 | 0.0005 +w | 12.3 +/- 0.930 | -0.009 +/- 1.000 | 0.044 +/- 0.500 | 0.185 +/- 1.000 | 1.85 +/- 5.000 |
| And Bay                                 | 14             | 403 GL179485        | 11/1999/05/12 | 31.2 +/- 11.000 | 0.0005 +w | 12.3 +/- 0.930 | -0.009 +/- 1.000 | 0.044 +/- 0.500 | 0.185 +/- 1.000 | 1.85 +/- 5.000 |
| Near Shanty Island                      | 14             | 404 GL179486        | 11/1999/05/12 | 31.2 +/- 11.000 | 0.0005 +w | 12.3 +/- 0.930 | -0.009 +/- 1.000 | 0.044 +/- 0.500 | 0.185 +/- 1.000 | 1.85 +/- 5.000 |
| Near Little Island                      | 14             | 405 GL179487        | 11/1999/05/12 | 31.2 +/- 11.000 | 0.0005 +w | 12.3 +/- 0.930 | -0.009 +/- 1.000 | 0.044 +/- 0.500 | 0.185 +/- 1.000 | 1.85 +/- 5.000 |
| <i>Summer</i>                           |                |                     |               |                 |           |                |                  |                 |                 |                |
| Mouth of Spanish River                  | 14             | 400 GL177455        | 11/1999/08/10 | 52.0 +/- 7      | 0.0005 +w | 20.3 +/- 2.51  | 0.000 +/- 0.1    | 0.040 +/- 0.05  | 0.200 +/- 0.1   | 0.46 +/- 0.5   |
| Wakabuck Channel                        | 14             | 401 GL177456        | 11/1999/08/10 | 8.0 +/- 1       | 0.0005 +w | 11.6 +/- 1.15  | 0.000 +/- 0.1    | 0.010 +/- 0.05  | 0.100 +/- 0.1   | 1.30 +/- 0.5   |
| Wakabuck Channel                        | 14             | 401 GL177457        | 11/1999/08/10 | 10.0 +/- 2      | 0.0005 +w | 12.2 +/- 1.14  | 0.000 +/- 0.1    | 0.010 +/- 0.05  | 0.100 +/- 0.1   | 1.30 +/- 0.5   |
| Wakabuck Channel (near Greenway Island) | 14             | 209 GL177458        | 11/1999/08/10 | 9.0 +/- 1       | 0.0005 +w | 12.1 +/- 1.53  | 0.000 +/- 0.1    | 0.020 +/- 0.05  | 0.100 +/- 0.1   | 1.50 +/- 0.5   |
| And Bay                                 | 14             | 402 GL177459        | 11/1999/08/10 | 9.0 +/- 1       | 0.0005 +w | 11.6 +/- 0.6   | -0.100 +/- 0.1   | 0.020 +/- 0.05  | 0.100 +/- 0.1   | 1.30 +/- 0.5   |
| Near Shanty Island                      | 14             | 403 GL177460        | 11/1999/08/10 | 14.0 +/- 1      | 0.0005 +w | 13.2 +/- 1.57  | -0.100 +/- 0.1   | 0.020 +/- 0.05  | 0.100 +/- 0.1   | 1.30 +/- 0.5   |
| Near Little Island                      | 14             | 404 GL177461        | 11/1999/08/10 | 6.0 +/- 1       | 0.0005 +w | 12.4 +/- 0.82  | -0.100 +/- 0.1   | 0.010 +/- 0.05  | 0.000 +/- 0.1   | 0.30 +/- 0.5   |
| <i>Fall</i>                             |                |                     |               |                 |           |                |                  |                 |                 |                |
| Mouth of Spanish River                  | 14             | 400 GL184053        | 11/1999/10/20 | 79.0 +/- 5      | 0.0005 +w | 16.3 +/- 1.23  | -0.200 +/- 0.5   | 0.020 +/- 0.05  | 0.200 +/- 0.1   | 0.40 +/- 0.5   |
| Wakabuck Channel                        | 14             | 401 GL184054        | 11/1999/10/20 | 10.0 +/- 2      | 0.0005 +w | 13.1 +/- 0.93  | -0.200 +/- 0.5   | 0.000 +/- 0.05  | 0.100 +/- 0.1   | 0.30 +/- 0.5   |
| Wakabuck Channel (near Greenway Island) | 14             | 209 GL184055        | 11/1999/10/20 | 10.0 +/- 2      | 0.0005 +w | 13.0 +/- 0.78  | -0.200 +/- 0.5   | 0.000 +/- 0.05  | 0.100 +/- 0.1   | 0.30 +/- 0.5   |
| And Bay                                 | 14             | 402 GL184056        | 11/1999/10/20 | 24.0 +/- 2      | 0.0005 +w | 13.4 +/- 0.71  | -0.200 +/- 0.5   | 0.000 +/- 0.05  | 0.100 +/- 0.1   | 0.40 +/- 0.5   |
| Near Shanty Island                      | 14             | 403 GL184057        | 11/1999/10/20 | 47.0 +/- 8      | 0.0005 +w | 14.6 +/- 1.04  | -0.200 +/- 0.5   | 0.020 +/- 0.05  | 0.100 +/- 0.1   | 0.40 +/- 0.5   |
| Near Little Island                      | 14             | 404 GL184058        | 11/1999/10/20 | 21.0 +/- 2      | 0.0005 +w | 15.1 +/- 1.05  | -0.100 +/- 0.5   | 0.010 +/- 0.05  | 0.100 +/- 0.1   | 0.30 +/- 0.5   |
| Near Little Island                      | 14             | 404 GL184059        | 11/1999/10/20 | 8.0 +/- 1       | 0.0005 +w | 13.7 +/- 0.75  | -0.200 +/- 0.5   | -0.010 +/- 0.05 | 0.000 +/- 0.1   | 0.50 +/- 0.5   |
| <b>Nipigon Bay</b>                      |                |                     |               |                 |           |                |                  |                 |                 |                |
| <i>Spring</i>                           |                |                     |               |                 |           |                |                  |                 |                 |                |
| Downstream of Nipigon R                 | 11             | 458 GL179431        | 11/1999/05/22 | 106.0 +/- 10.6  | 0.0005 +w | 9.9 +/- 0.993  | 0.016 +/- 0.1    | 0.006 +/- 0.05  | 0.110 +/- 0.1   | 1.06 +/- 0.5   |
| Nipigon Bay - 30 m S of mill outfall    | 11             | 459 GL179432        | 11/1999/05/22 | 121.0 +/- 12.1  | 0.0005 +w | 11.6 +/- 1.16  | 0.011 +/- 0.1    | 0.010 +/- 0.05  | 0.110 +/- 0.1   | 1.76 +/- 0.5   |
| Nipigon Bay - NW of Five Mile Pt        | 11             | 461 GL179433        | 11/1999/05/22 | 89.2 +/- 9.82   | 0.0005 +w | 10.5 +/- 1.05  | 0.008 +/- 0.1    | 0.000 +/- 0.05  | 0.076 +/- 0.1   | 1.47 +/- 0.5   |
| Nipigon Bay - West of Frig Island       | 11             | 869 GL179434        | 11/1999/05/22 | 143.0 +/- 14.3  | 0.0005 +w | 10.6 +/- 1.06  | 0.020 +/- 0.1    | 0.008 +/- 0.05  | 0.104 +/- 0.1   | 1.40 +/- 0.5   |
| 500 m south of mill outfall             | 11             | 1200 GL179435       | 11/1999/05/22 | 144.0 +/- 14.4  | 0.0005 +w | 12.5 +/- 1.25  | 0.027 +/- 0.1    | 0.011 +/- 0.05  | 0.106 +/- 0.1   | 0.41 +/- 0.5   |
| 500 m south of mill outfall             | 11             | 1200 GL179436       | 11/1999/05/22 | 143.0 +/- 14.3  | 0.0005 +w | 12.9 +/- 1.29  | 0.028 +/- 0.1    | 0.022 +/- 0.05  | 0.128 +/- 0.1   | 0.40 +/- 0.5   |
| <i>Summer</i>                           |                |                     |               |                 |           |                |                  |                 |                 |                |
| Downstream of Nipigon R                 | 11             | 458 GL177409        | 11/1999/08/01 | 48.0 +/- 3      | 0.0005 +w | 9.7 +/- 0.55   | 0.000 +/- 0.1    | 0.010 +/- 0.05  | 0.100 +/- 0.1   | 3.30 +/- 0.5   |
| Nipigon Bay - 30 m S of mill outfall    | 11             | 459 GL177410        | 11/1999/08/01 | 74.0 +/- 19     | 0.0005 +w | 10.2 +/- 0.65  | 0.000 +/- 0.1    | 0.010 +/- 0.05  | 0.100 +/- 0.1   | 4.00 +/- 0.5   |
| Nipigon Bay - NW of Five Mile Pt        | 11             | 460 GL177411        | 11/1999/08/01 | 48.0 +/- 3      | 0.0005 +w | 9.7 +/- 0.55   | 0.000 +/- 0.1    | 0.010 +/- 0.05  | 0.100 +/- 0.1   | 3.89 +/- 0.5   |
| Nipigon Bay - West of Frig Island       | 11             | 869 GL177412        | 11/1999/08/01 | 89.0 +/- 8.9    | 0.0005 +w | 11.4 +/- 0.82  | 0.000 +/- 0.1    | 0.010 +/- 0.05  | 0.100 +/- 0.1   | 3.50 +/- 0.5   |
| 500 m south of mill outfall             | 11             | 1200 GL177413       | 11/1999/08/01 | 52.0 +/- 4      | 0.0005 +w | 10.7 +/- 0.7   | 0.000 +/- 0.1    | 0.010 +/- 0.05  | 0.100 +/- 0.1   | 3.50 +/- 0.5   |
| <i>Fall</i>                             |                |                     |               |                 |           |                |                  |                 |                 |                |
| Downstream of Nipigon R                 | 11             | 458 GL184015        | 11/1999/10/11 | 55.0 +/- 4      | 0.0005 +w | 9.4 +/- 0.6    | 0.000 +/- 0.1    | 0.000 +/- 0.05  | 0.000 +/- 0.1   | 2.70 +/- 0.5   |
| Nipigon Bay - 30 m S of mill outfall    | 11             | 459 GL184016        | 11/1999/10/11 | 65.0 +/- 4      | 0.0005 +w | 10.2 +/- 0.2   | 0.000 +/- 0.1    | 0.010 +/- 0.05  | 0.100 +/- 0.1   | 2.70 +/- 0.5   |
| Nipigon Bay - NW of Five Mile Pt        | 11             | 461 GL184017        | 11/1999/10/11 | 74.0 +/- 17     | 0.0005 +w | 10.5 +/- 0.69  | 0.000 +/- 0.1    | 0.000 +/- 0.05  | 0.100 +/- 0.1   | 3.70 +/- 0.5   |
| Nipigon Bay - West of Frig Island       | 11             | 869 GL184018        | 11/1999/10/11 | 86.0 +/- 8      | 0.0005 +w | 10.5 +/- 1.1   | 0.000 +/- 0.1    | 0.010 +/- 0.05  | 0.100 +/- 0.1   | 1.20 +/- 0.5   |
| 500 m south of mill outfall             | 11             | 1200 GL184019       | 11/1999/10/11 | 66.0 +/- 5      | 0.0005 +w | 10.5 +/- 0.56  | 0.000 +/- 0.1    | 0.010 +/- 0.05  | 0.100 +/- 0.1   | 2.70 +/- 0.5   |
| 500 m south of mill outfall             | 11             | 1200 GL184020       | 11/1999/10/11 | 66.0 +/- 4      | 0.0005 +w | 10.3 +/- 0.73  | 0.000 +/- 0.1    | 0.040 +/- 0.06  | 0.100 +/- 0.1   | 2.70 +/- 0.5   |



Table 2: Metal concentrations in water collected from Lake Superior and the Spanish River, 1999

| Station Description                | Station number | Field Sample number | Date YYYYMMDD | Aluminum $\mu\text{g/L}$ | Arsenic $\mu\text{g/L}$ | Barium $\mu\text{g/L}$ | Beryllium $\mu\text{g/L}$ | Cadmium $\mu\text{g/L}$ | Cobalt $\mu\text{g/L}$ | Chromium $\mu\text{g/L}$ |
|------------------------------------|----------------|---------------------|---------------|--------------------------|-------------------------|------------------------|---------------------------|-------------------------|------------------------|--------------------------|
| <b>Jacobsen Bay</b>                |                |                     |               |                          |                         |                        |                           |                         |                        |                          |
| Spring                             | 1              | 701 GL978421        | 19990526      | 142.0 $\pm$ 14.000       | 0.0095 $\pm$ 0.0005     | 41.7 $\pm$ 2.500       | -0.027 $\pm$ 1.000        | -0.011 $\pm$ 0.500      | 0.120 $\pm$ 1.000      | 4.56 $\pm$ 5.000         |
| Blackbird Creek - mouth            | 1              | 702 GL978419        | 19990526      | 27.2 $\pm$ 11.000        | 0.0095 $\pm$ 0.0005     | 14.2 $\pm$ 1.100       | 0.006 $\pm$ 1.000         | -0.086 $\pm$ 0.500      | 0.024 $\pm$ 1.000      | 1.82 $\pm$ 5.000         |
| McNelly Bay                        | 1              | 703 GL978420        | 19990526      | 26.2 $\pm$ 10.000        | 0.0095 $\pm$ 0.0005     | 13.9 $\pm$ 0.970       | 0.009 $\pm$ 1.000         | -0.098 $\pm$ 0.500      | 0.026 $\pm$ 1.000      | 2.05 $\pm$ 5.000         |
| Downstream of McNelly Bay          | 1              | 710 GL978418        | 19990526      | 10.1 $\pm$ 10.000        | 0.0095 $\pm$ 0.0005     | 10.2 $\pm$ 0.760       | -0.004 $\pm$ 1.000        | -0.081 $\pm$ 0.510      | 0.018 $\pm$ 1.000      | 1.71 $\pm$ 5.000         |
| Jacobsen Bay                       | 1              | 451 GL978417        | 19990526      | 8.4 $\pm$ 10.000         | 0.0095 $\pm$ 0.0005     | 9.6 $\pm$ 0.710        | 0.014 $\pm$ 1.000         | -0.040 $\pm$ 0.500      | 0.021 $\pm$ 1.000      | 2.03 $\pm$ 5.000         |
| Near Terrace Bay at Kimberly Clark | 1              | 452 GL978423        | 19990526      | 3.3 $\pm$ 10.000         | 0.0095 $\pm$ 0.0005     | 6.6 $\pm$ 0.710        | 0.003 $\pm$ 1.000         | -0.115 $\pm$ 0.510      | 0.017 $\pm$ 1.000      | 1.98 $\pm$ 5.000         |
| Summer                             | 1              | 701 GL977459        | 19990603      | 226.0 $\pm$ 12.0         | 0.0095 $\pm$ 0.0005     | 143.0 $\pm$ 74.7       | 0.000 $\pm$ 0.1           | 0.200 $\pm$ 0.18        | 0.200 $\pm$ 0.1        | 8.90 $\pm$ 0.8           |
| Blackbird Creek - mouth            | 1              | 702 GL977458        | 19990603      | 20.0 $\pm$ 4.4           | 0.0095 $\pm$ 0.0005     | 17.1 $\pm$ 1.02        | 0.000 $\pm$ 0.1           | 0.030 $\pm$ 0.05        | 0.000 $\pm$ 0.1        | 2.49 $\pm$ 0.5           |
| McNelly Bay                        | 1              | 703 GL977457        | 19990603      | 13.0 $\pm$ 2.3           | 0.0095 $\pm$ 0.0005     | 11.8 $\pm$ 0.77        | 0.000 $\pm$ 0.1           | 0.030 $\pm$ 0.05        | 0.000 $\pm$ 0.1        | 1.90 $\pm$ 0.5           |
| Downstream of McNelly Bay          | 1              | 710 GL977456        | 19990603      | 10.0 $\pm$ 1.1           | 0.0095 $\pm$ 0.0005     | 11.7 $\pm$ 0.82        | 0.000 $\pm$ 0.1           | 0.030 $\pm$ 0.05        | 0.000 $\pm$ 0.1        | 2.00 $\pm$ 0.5           |
| Jacobsen Bay                       | 1              | 452 GL977455        | 19990603      | 5.0 $\pm$ 1.1            | 0.0095 $\pm$ 0.0005     | 10.4 $\pm$ 1.32        | 0.000 $\pm$ 0.1           | 0.010 $\pm$ 0.05        | 0.000 $\pm$ 0.1        | 1.86 $\pm$ 0.5           |
| Near Terrace Bay at Kimberly Clark | 1              | 453 GL977454        | 19990603      | 5.0 $\pm$ 1.1            | 0.0095 $\pm$ 0.0005     | 10.3 $\pm$ 0.59        | 0.000 $\pm$ 0.1           | 0.010 $\pm$ 0.05        | 0.000 $\pm$ 0.1        | 1.80 $\pm$ 0.5           |
| Fall                               | 1              | 701 GL954028        | 19991013      | 78.0 $\pm$ 4.4           | 0.0095 $\pm$ 0.0005     | 20.7 $\pm$ 1.44        | 0.000 $\pm$ 0.1           | 0.040 $\pm$ 0.05        | 0.100 $\pm$ 0.1        | 2.30 $\pm$ 0.5           |
| Blackbird Creek - mouth            | 1              | 702 GL954029        | 19991013      | 81.0 $\pm$ 5.5           | 0.0095 $\pm$ 0.0005     | 22.1 $\pm$ 0.53        | 0.000 $\pm$ 0.1           | 0.040 $\pm$ 0.05        | 0.100 $\pm$ 0.1        | 2.30 $\pm$ 0.5           |
| McNelly Bay                        | 1              | 703 GL954027        | 19991013      | 35.0 $\pm$ 9.9           | 0.0095 $\pm$ 0.0005     | 11.1 $\pm$ 0.73        | 0.000 $\pm$ 0.1           | -0.010 $\pm$ 0.05       | 0.000 $\pm$ 0.1        | 0.80 $\pm$ 0.5           |
| Downstream of McNelly Bay          | 1              | 710 GL954026        | 19991013      | 6.0 $\pm$ 1.1            | 0.0095 $\pm$ 0.0005     | 8.3 $\pm$ 0.67         | 0.000 $\pm$ 0.1           | 0.000 $\pm$ 0.05        | 0.000 $\pm$ 0.1        | 0.60 $\pm$ 0.5           |
| Jacobsen Bay                       | 1              | 452 GL954025        | 19991013      | 6.0 $\pm$ 1.1            | 0.0095 $\pm$ 0.0005     | 8.4 $\pm$ 0.74         | 0.000 $\pm$ 0.1           | 0.010 $\pm$ 0.05        | 0.000 $\pm$ 0.1        | 1.70 $\pm$ 0.5           |
| Near Terrace Bay at Kimberly Clark | 1              | 453 GL954024        | 19991013      | 5.0 $\pm$ 1.1            | 0.0095 $\pm$ 0.0005     | 8.1 $\pm$ 0.57         | 0.000 $\pm$ 0.1           | 0.000 $\pm$ 0.05        | 0.000 $\pm$ 0.1        | 1.60 $\pm$ 0.5           |
| <b>Pine River</b>                  |                |                     |               |                          |                         |                        |                           |                         |                        |                          |
| Spring                             | 1              | 20 GL978410         | 19990519      | 14.4 $\pm$ 10.000        | 0.0095 $\pm$ 0.0005     | 9.7 $\pm$ 0.810        | 0.011 $\pm$ 1.000         | -0.074 $\pm$ 0.500      | 0.026 $\pm$ 1.000      | 2.09 $\pm$ 5.000         |
| Pine River - mouth                 | 1              | 20 GL978411         | 19990519      | 14.4 $\pm$ 10.000        | 0.0095 $\pm$ 0.0005     | 9.7 $\pm$ 0.780        | 0.026 $\pm$ 1.000         | -0.067 $\pm$ 0.510      | 0.024 $\pm$ 1.000      | 2.18 $\pm$ 5.000         |
| Pine River - south of mouth        | 1              | 454 GL978413        | 19990519      | 138.0 $\pm$ 14.000       | 0.0095 $\pm$ 0.0005     | 11.2 $\pm$ 0.850       | 0.007 $\pm$ 1.000         | -0.081 $\pm$ 0.500      | 0.161 $\pm$ 1.000      | 2.93 $\pm$ 5.000         |
| Pine River - west of mouth         | 1              | 457 GL978412        | 19990519      | 162.0 $\pm$ 17.000       | 0.0095 $\pm$ 0.0005     | 45.8 $\pm$ 2.400       | 0.041 $\pm$ 1.000         | -0.044 $\pm$ 0.500      | 0.463 $\pm$ 1.000      | 31.00 $\pm$ 3.900        |
| North of Pk. R. by Heron Bay       | 1              | 21 GL978414         | 19990519      | 11.9 $\pm$ 10.000        | 0.0095 $\pm$ 0.0005     | 9.7 $\pm$ 0.820        | 0.009 $\pm$ 1.000         | -0.071 $\pm$ 0.500      | 0.022 $\pm$ 1.000      | 1.29 $\pm$ 3.600         |
| Summer                             | 1              | 20 GL977444         | 19990605      | 39.4 $\pm$ 3.94          | 0.0095 $\pm$ 0.0005     | 10.7 $\pm$ 1.07        | -0.071 $\pm$ 0.1          | 0.038 $\pm$ 0.05        | 0.033 $\pm$ 0.1        | 1.79 $\pm$ 0.5           |
| Pine River - mouth                 | 1              | 453 GL977445        | 19990605      | 175.0 $\pm$ 17.5         | 0.0095 $\pm$ 0.0005     | 18.1 $\pm$ 1.81        | 0.023 $\pm$ 0.1           | 0.038 $\pm$ 0.05        | 0.189 $\pm$ 0.1        | 4.38 $\pm$ 0.5           |
| Pine River - south                 | 1              | 453 GL977446        | 19990605      | 198.0 $\pm$ 18.9         | 0.0095 $\pm$ 0.0005     | 16.4 $\pm$ 1.64        | -0.005 $\pm$ 0.1          | 0.029 $\pm$ 0.05        | 0.165 $\pm$ 0.1        | 3.73 $\pm$ 0.5           |
| Pine River - mouth                 | 1              | 453 GL977447        | 19990605      | 1.2 $\pm$ 0.1            | 0.0095 $\pm$ 0.0005     | 0.9 $\pm$ 0.05         | -0.004 $\pm$ 0.1          | 0.028 $\pm$ 0.05        | 0.058 $\pm$ 0.1        | 0.20 $\pm$ 0.5           |
| North of Pk. R. by Heron Bay       | 1              | 21 GL977443         | 19990605      | 5.8 $\pm$ 1.1            | 0.0095 $\pm$ 0.0005     | 10.1 $\pm$ 1.01        | -0.010 $\pm$ 0.1          | 0.078 $\pm$ 0.05        | 0.022 $\pm$ 0.1        | 2.03 $\pm$ 0.5           |
| Fall                               | 1              | 20 GL974037         | 19991015      | 5.0 $\pm$ 1.1            | 0.0095 $\pm$ 0.0005     | 10.8 $\pm$ 0.93        | 0.209 $\pm$ 0.3           | 0.000 $\pm$ 0.05        | 0.000 $\pm$ 0.1        | 0.70 $\pm$ 0.5           |
| Pine River                         | 1              | 20 GL974038         | 19991015      | 5.0 $\pm$ 1.1            | 0.0095 $\pm$ 0.0005     | 10.7 $\pm$ 0.78        | 0.000 $\pm$ 0.3           | 0.010 $\pm$ 0.05        | 0.000 $\pm$ 0.1        | 0.10 $\pm$ 0.5           |
| Pine River - mouth                 | 1              | 20 GL974039         | 19991015      | 235.0 $\pm$ 18.0         | 0.0095 $\pm$ 0.0005     | 13.1 $\pm$ 0.89        | 0.108 $\pm$ 0.3           | 0.010 $\pm$ 0.05        | 0.300 $\pm$ 0.1        | 0.90 $\pm$ 0.5           |
| Pine River - south                 | 1              | 454 GL974040        | 19991015      | 207.0 $\pm$ 14.4         | 0.0095 $\pm$ 0.0005     | 12.6 $\pm$ 0.79        | -0.108 $\pm$ 0.2          | 0.010 $\pm$ 0.05        | 0.200 $\pm$ 0.1        | 1.00 $\pm$ 0.5           |
| Pine River - west of mouth         | 1              | 457 GL974041        | 19991015      | 227.0 $\pm$ 18.0         | 0.0095 $\pm$ 0.0005     | 12.5 $\pm$ 0.81        | -0.100 $\pm$ 0.3          | 0.010 $\pm$ 0.05        | 0.200 $\pm$ 0.1        | 1.10 $\pm$ 0.5           |
| North of Pk. R. by Heron Bay       | 1              | 21 GL974036         | 19991015      | 7.0 $\pm$ 1.1            | 0.0095 $\pm$ 0.0005     | 10.1 $\pm$ 0.66        | 0.201 $\pm$ 0.3           | 0.020 $\pm$ 0.05        | 0.000 $\pm$ 0.1        | 1.00 $\pm$ 0.4           |
| PWGD (u.g/L)                       |                |                     | 70            | 100                      | 100                     | 0.3                    | 0.3                       | 0.3                     | 0.3                    | CAV 1                    |



**Table 2: Metal concentrations in water collected from Lake Superior and the Spanish River, 1999**

| Station number                             | Field sample number | Date YYYYMMDD | Species  | Iron ug/L      | Manganese ug/L   | Aluminum ug/L | Nickel ug/L    | Lead ug/L      | Strontium ug/L | Barium ug/L    | Zinc ug/L       |
|--|---------------------|---------------|----------|----------------|------------------|---------------|----------------|----------------|----------------|----------------|-----------------|
| Spanish River                              |                     |               |          |                |                  |               |                |                |                |                |                 |
| Spring                                     |                     |               |          |                |                  |               |                |                |                |                |                 |
| 14   | 400 GL072601        | 11            | 19080512 | 4.06 +/- 5.000 | 130.0 +/- 51.000 | 2.65          | 42.1 +/- 2.500 | 27.6 +/- 1.700 | 0.17 +/- 0.300 | 39.0 +/- 2.800 | 1.23 +/- 2.000  |
| Mouth of Spanish River                     |                     |               |          |                |                  |               |                |                |                |                |                 |
| 14   | 401 GL072602        | 11            | 19080512 | 2.48 +/- 5.000 | 86.5 +/- 53.000  | 2.10          | 24.0 +/- 2.200 | 21.7 +/- 1.000 | 0.16 +/- 0.300 | 45.5 +/- 3.400 | 0.97 +/- 1.000  |
| Mushakatska Channel                        |                     |               |          |                |                  |               |                |                |                |                |                 |
| 14   | 402 GL072603        | 11            | 19080512 | 2.46 +/- 5.000 | 81.4 +/- 50.000  | 2.40          | 24.0 +/- 2.200 | 21.7 +/- 1.000 | 0.09 +/- 0.300 | 48.5 +/- 3.600 | 0.85 +/- 2.000  |
| Mushakatska Channel (near Greenway Island) |                     |               |          |                |                  |               |                |                |                |                |                 |
| 14   | 206 GL072605        | 11            | 19080712 | 2.36 +/- 3.000 | 61.4 +/- 50.000  | 3.05          | 21.8 +/- 1.100 | 21.2 +/- 2.000 | 0.07 +/- 0.500 | 40.5 +/- 2.500 | 0.81 +/- 2.100  |
| Arby Bay                                   |                     |               |          |                |                  |               |                |                |                |                |                 |
| 14   | 402 GL072606        | 11            | 19080512 | 2.36 +/- 3.000 | 61.4 +/- 50.000  | 3.05          | 21.8 +/- 1.100 | 21.2 +/- 2.000 | 0.07 +/- 0.500 | 40.5 +/- 2.500 | 0.81 +/- 2.100  |
| Near Shady Island                          |                     |               |          |                |                  |               |                |                |                |                |                 |
| 14   | 402 GL072607        | 11            | 19080512 | 2.40 +/- 3.000 | 65.8 +/- 50.000  | 3.45          | 22.2 +/- 1.500 | 21.2 +/- 2.000 | 0.07 +/- 0.500 | 40.5 +/- 2.500 | 0.81 +/- 2.100  |
| Near Shady Island                          |                     |               |          |                |                  |               |                |                |                |                |                 |
| 14   | 402 GL072608        | 11            | 19080512 | 2.40 +/- 3.000 | 65.8 +/- 50.000  | 3.75          | 24.4 +/- 1.100 | 21.4 +/- 1.100 | 0.06 +/- 0.500 | 48.7 +/- 4.300 | 0.81 +/- 2.100  |
| Near Little Deak                           |                     |               |          |                |                  |               |                |                |                |                |                 |
| 14   | 404 GL072609        | 11            | 19080512 | 2.68 +/- 3.000 | 43.2 +/- 50.000  | 2.05          | 25.5 +/- 1.000 | 0.19 +/- 0.500 | 0.02 +/- 0.500 | 77.6 +/- 4.300 | 0.16 +/- 1.000  |
| Summer                                     |                     |               |          |                |                  |               |                |                |                |                |                 |
| Mouth of Spanish River                     |                     |               |          |                |                  |               |                |                |                |                |                 |
| 14   | 400 GL072651        | 11            | 19080810 | 2.30 +/- 0.5   | 133.0 +/- 11     | 2.55          | 46.8 +/- 3.6   | 16.5 +/- 1.8   | 0.12 +/- 0.05  | 58.5 +/- 5.8   | 2.000 +/- 0.3   |
| Mushakatska Channel                        |                     |               |          |                |                  |               |                |                |                |                |                 |
| 14   | 401 GL072652        | 11            | 19080810 | 1.10 +/- 0.5   | 12.0 +/- 0.5     | 8.40          | 7.6 +/- 0.8    | 0.30 +/- 0.5   | 0.02 +/- 0.05  | 85.1 +/- 8.1   | 0.400 +/- 0.2   |
| Mushakatska Channel                        |                     |               |          |                |                  |               |                |                |                |                |                 |
| 14   | 401 GL072653        | 11            | 19080810 | 1.10 +/- 0.5   | 14.0 +/- 0.5     | 8.15          | 7.7 +/- 0.8    | 0.30 +/- 0.5   | 0.04 +/- 0.05  | 68.5 +/- 3.7   | 0.600 +/- 0.5   |
| Mushakatska Channel (near Greenway Island) |                     |               |          |                |                  |               |                |                |                |                |                 |
| 14   | 206 GL072655        | 11            | 19080810 | 1.00 +/- 0.5   | 7.0 +/- 0.5      | 8.15          | 5.0 +/- 0.5    | 0.30 +/- 0.5   | 0.02 +/- 0.05  | 65.1 +/- 6.3   | 0.300 +/- 0.2   |
| Arby Bay                                   |                     |               |          |                |                  |               |                |                |                |                |                 |
| 14   | 402 GL072656        | 11            | 19080810 | 1.10 +/- 0.5   | 14.0 +/- 0.5     | 8.40          | 8.4 +/- 0.5    | 0.30 +/- 0.5   | 0.04 +/- 0.05  | 62.8 +/- 3.2   | 0.400 +/- 0.2   |
| Near Shady Island                          |                     |               |          |                |                  |               |                |                |                |                |                 |
| 14   | 402 GL072657        | 11            | 19080810 | 1.50 +/- 0.5   | 31.0 +/- 0.5     | 2.80          | 18.5 +/- 1     | 0.30 +/- 0.5   | 0.05 +/- 0.05  | 73.4 +/- 0.5   | 1.5 +/- 0.2     |
| Near Little Deak                           |                     |               |          |                |                  |               |                |                |                |                |                 |
| 14   | 404 GL072658        | 11            | 19080810 | 0.50 +/- 0.5   | 5.0 +/- 0.5      | 1.80          | 15.0 +/- 1     | 0.20 +/- 0.2   | 0.02 +/- 0.05  | 29.0 +/- 0.2   | 0.300 +/- 0.2   |
| Mouth of Spanish River                     |                     |               |          |                |                  |               |                |                |                |                |                 |
| 14   | 400 GL072659        | 11            | 19081020 | 2.70 +/- 0.5   | 103.0 +/- 11     | 2.05          | 58.0 +/- 3.2   | 30.1 +/- 1.2   | 0.10 +/- 0.08  | 64.1 +/- 3.8   | 3.100 +/- 0.4   |
| Mushakatska Channel                        |                     |               |          |                |                  |               |                |                |                |                |                 |
| 14   | 401 GL072661        | 11            | 19081020 | 1.30 +/- 0.5   | 22.0 +/- 0.5     | 0.45          | 10.0 +/- 0.5   | 0.40 +/- 0.5   | 0.04 +/- 0.05  | 75.0 +/- 0.5   | 0.800 +/- 0.4   |
| Mushakatska Channel (near Greenway Island) |                     |               |          |                |                  |               |                |                |                |                |                 |
| 14   | 206 GL072662        | 11            | 19081020 | 1.30 +/- 0.5   | 20.0 +/- 0.5     | 0.60          | 10.1 +/- 0.2   | 0.40 +/- 0.5   | 0.07 +/- 0.05  | 68.0 +/- 0.5   | 0.800 +/- 0.4   |
| Arby Bay                                   |                     |               |          |                |                  |               |                |                |                |                |                 |
| 14   | 402 GL072663        | 11            | 19081020 | 1.50 +/- 0.5   | 54.0 +/- 0.5     | 0.60          | 10.3 +/- 0.8   | 0.40 +/- 0.5   | 0.07 +/- 0.05  | 76.0 +/- 0.5   | 1.500 +/- 0.2   |
| Near Shady Island                          |                     |               |          |                |                  |               |                |                |                |                |                 |
| 14   | 401 GL072664        | 11            | 19081020 | 1.10 +/- 0.5   | 27.4 +/- 0.5     | 0.40          | 6.0 +/- 0.5    | 0.70 +/- 0.5   | 0.02 +/- 0.05  | 72.0 +/- 0.5   | 0.800 +/- 0.3   |
| Near Shady Island                          |                     |               |          |                |                  |               |                |                |                |                |                 |
| 14   | 402 GL072665        | 14            | 19081020 | 1.90 +/- 0.5   | 56.0 +/- 7       | 0.90          | 20.1 +/- 1.7   | 0.70 +/- 0.8   | 0.06 +/- 0.05  | 66.0 +/- 5.5   | 0.900 +/- 0.5   |
| Near Little Deak                           |                     |               |          |                |                  |               |                |                |                |                |                 |
| 14   | 404 GL072667        | 11            | 19081020 | 0.80 +/- 0.5   | 12.0 +/- 0.5     | 0.30 +/- 0.2  | 0.40 +/- 0.5   | 1.8 +/- 0.1    | 0.34 +/- 0.05  | 83.1 +/- 11.1  | 0.400 +/- 0.3   |
| Nigpog Bay                                 |                     |               |          |                |                  |               |                |                |                |                |                 |
| Spring                                     |                     |               |          |                |                  |               |                |                |                |                |                 |
| 1  | 456 GL076431        | 11            | 19080522 | 1.27 +/- 0.5   | 125.0 +/- 12.6   | 0.70          | 5.5 +/- 0.546  | 0.00 +/- 0.05  | 0.36 +/- 0.07  | 21.5 +/- 2.15  | 0.240 +/- 0.041 |
| Southwest of Nigpog R.                     |                     |               |          |                |                  |               |                |                |                |                |                 |
| 1  | 458 GL076432        | 11            | 19080522 | 1.42 +/- 0.5   | 135.0 +/- 13.5   | 2.35          | 7.1 +/- 0.712  | 0.17 +/- 0.05  | 0.06 +/- 0.12  | 33.8 +/- 2.36  | 0.210 +/- 0.021 |
| Nigpog Bay - 20 m S of 2nd reef            |                     |               |          |                |                  |               |                |                |                |                |                 |
| 1  | 461 GL076433        | 11            | 19080522 | 1.12 +/- 0.5   | 102.0 +/- 10.3   | 0.95          | 3.8 +/- 0.394  | 0.04 +/- 0.05  | 0.44 +/- 0.235 | 32.8 +/- 2.23  | 0.420 +/- 0.049 |
| Nigpog Bay - NW of Paa Ma Pt               |                     |               |          |                |                  |               |                |                |                |                |                 |
| 1  | 898 GL076434        | 11            | 19080522 | 1.14 +/- 0.5   | 133.0 +/- 14.5   | 1.25          | 5.0 +/- 0.517  | 0.12 +/- 0.05  | 0.44 +/- 0.108 | 32.8 +/- 2.24  | 0.840 +/- 0.115 |
| 500 m south of reef coral                  |                     |               |          |                |                  |               |                |                |                |                |                 |
| 1  | 1200 GL076435       | 14            | 19080522 | 1.37 +/- 0.5   | 145.0 +/- 14.5   | 1.75          | 8.7 +/- 0.872  | 0.17 +/- 0.05  | 0.08 +/- 0.51  | 21.9 +/- 2.35  | 0.954 +/- 0.072 |
| Southwest of Nigpog R.                     |                     |               |          |                |                  |               |                |                |                |                |                 |
| 1  | 1200 GL076436       | 14            | 19080522 | 1.45 +/- 0.5   | 144.0 +/- 14.4   | 1.55          | 6.8 +/- 0.88   | 0.15 +/- 0.05  | 0.32 +/- 0.321 | 20.2 +/- 0.05  | 0.840 +/- 0.154 |
| Southwest of Nigpog R.                     |                     |               |          |                |                  |               |                |                |                |                |                 |
| 1  | 456 GL076437        | 11            | 19080601 | 1.39 +/- 0.5   | 47.0 +/- 6.8     | 1.50          | 3.5 +/- 0.42   | 0.05 +/- 0.05  | 0.27 +/- 0.27  | 37.6 +/- 4.3   | 1.080 +/- 0.106 |
| Nigpog Bay - 20 m S of 2nd reef            |                     |               |          |                |                  |               |                |                |                |                |                 |
| 1  | 458 GL076438        | 11            | 19080601 | 1.46 +/- 0.5   | 77.0 +/- 12.2    | 3.00          | 3.9 +/- 0.8    | 0.44 +/- 0.4   | 0.06 +/- 0.05  | 3.200 +/- 0.5  | 0.950 +/- 0.05  |
| Nigpog Bay - NW of Paa Ma Pt               |                     |               |          |                |                  |               |                |                |                |                |                 |
| 1  | 461 GL076439        | 11            | 19080601 | 1.46 +/- 0.5   | 80.0 +/- 8.5     | 2.55          | 4.0 +/- 0.8    | 0.09 +/- 0.09  | 0.27 +/- 0.05  | 21.8 +/- 1.5   | 4.600 +/- 0.17  |
| Nigpog Bay - NW of Paa Ma Pt               |                     |               |          |                |                  |               |                |                |                |                |                 |
| 1  | 461 GL076440        | 11            | 19080601 | 1.30 +/- 0.5   | 45.0 +/- 6.5     | 4.00          | 2.8 +/- 0.3    | 0.10 +/- 0.05  | 0.34 +/- 0.4   | 3.200 +/- 0.5  | 0.780 +/- 0.14  |
| Nigpog Bay - NW of Paa Ma Pt               |                     |               |          |                |                  |               |                |                |                |                |                 |
| 1  | 898 GL076441        | 11            | 19080601 | 1.52 +/- 0.5   | 75.0 +/- 8.5     | 1.75          | 2.2 +/- 0.31   | 0.09 +/- 0.09  | 0.27 +/- 0.05  | 21.8 +/- 1.2   | 3.500 +/- 0.11  |
| 500 m south of reef coral                  |                     |               |          |                |                  |               |                |                |                |                |                 |
| 1  | 1200 GL076442       | 11            | 19080601 | 1.30 +/- 0.5   | 42.0 +/- 6.8     | 1.10          | 3.7 +/- 0.52   | 0.10 +/- 0.05  | 0.33 +/- 0.38  | 22.8 +/- 1.6   | 5.000 +/- 0.08  |
| Southwest of Nigpog R.                     |                     |               |          |                |                  |               |                |                |                |                |                 |
| 1  | 456 GL084015        | 11            | 19081011 | 1.80 +/- 0.5   | 47.0 +/- 5       | 0.80          | 3.4 +/- 0.2    | 0.08 +/- 0.05  | 0.18 +/- 0.19  | 1.500 +/- 0.4  | 0.500 +/- 0.05  |
| Nigpog Bay - 20 m S of 2nd reef            |                     |               |          |                |                  |               |                |                |                |                |                 |
| 1  | 458 GL084020        | 11            | 19081011 | 1.30 +/- 0.5   | 73.0 +/- 5       | 0.40          | 4.0 +/- 0.2    | 0.10 +/- 0.05  | 0.03 +/- 0.05  | 22.7 +/- 1.4   | 3.100 +/- 0.3   |
| Nigpog Bay - NW of Paa Ma Pt               |                     |               |          |                |                  |               |                |                |                |                |                 |
| 1  | 461 GL084037        | 11            | 19081011 | 1.30 +/- 0.5   | 80.0 +/- 7.8     | 1.00          | 4.5 +/- 1      | 0.09 +/- 0.05  | 0.08 +/- 0.2   | 33.0 +/- 2.1   | 3.500 +/- 0.12  |
| Nigpog Bay - NW of Paa Ma Pt               |                     |               |          |                |                  |               |                |                |                |                |                 |
| 1  | 898 GL084016        | 11            | 19081011 | 1.30 +/- 0.5   | 74.0 +/- 11      | 0.45          | 4.1 +/- 0.4    | 0.10 +/- 0.05  | 0.04 +/- 0.1   | 32.0 +/- 1.6   | 3.300 +/- 0.6   |
| 500 m south of reef coral                  |                     |               |          |                |                  |               |                |                |                |                |                 |
| 1  | 1200 GL084017       | 14            | 19081011 | 1.40 +/- 0.5   | 75.0 +/- 6       | 0.40          | 4.1 +/- 0.2    | 0.20 +/- 0.05  | 0.08 +/- 0.1   | 32.8 +/- 1.2   | 2.800 +/- 0.5   |
| Southwest of Nigpog R.                     |                     |               |          |                |                  |               |                |                |                |                |                 |
| 1  | 1200 GL084018       | 14            | 19081011 | 1.40 +/- 0.5   | 75.0 +/- 6       | 0.10          | 4.1 +/- 0.2    | 0.12 +/- 0.16  | 0.22 +/- 0.2   | 32.8 +/- 1.2   | 0.560 +/- 0.08  |
| 500 m south of reef coral                  |                     |               |          |                |                  |               |                |                |                |                |                 |



Table 2: Metal concentrations in water collected from Lake Superior and the Spanish River, 1999

| Station number                        | Field sample number | Date YYYYMMDD | Copper $\mu\text{g/L}$ | Iron $\mu\text{g/L}$ | Manganese $\mu\text{g/L}$ | Molybdenum $\mu\text{g/L}$ | Nickel $\mu\text{g/L}$ | Lead $\mu\text{g/L}$ | Strontium $\mu\text{g/L}$ | Titanium $\mu\text{g/L}$ | Vanadium $\mu\text{g/L}$ | Zinc $\mu\text{g/L}$ |
|---------------------------------------|---------------------|---------------|------------------------|----------------------|---------------------------|----------------------------|------------------------|----------------------|---------------------------|--------------------------|--------------------------|----------------------|
| <b>Jackfish Bay</b>                   |                     |               |                        |                      |                           |                            |                        |                      |                           |                          |                          |                      |
| 1                                     | 701 Q176421         | 11 19990525   | 0.17 $\pm$ 5.000       | 162.0 $\pm$ 54.000   | 184.2 $\pm$ 11.800        | 0.32 $\pm$ 5.000           | 1.8 $\pm$ 1.000        | 0.06 $\pm$ 0.100     | 82.0 $\pm$ 3.300          | 8.40 $\pm$ 3.100         | 3.270 $\pm$ 1.100        | 11.9 $\pm$ 2.100     |
| 1                                     | 702 Q176419         | 14 19990525   | 0.84 $\pm$ 5.000       | 31.9 $\pm$ 50.000    | 28.4 $\pm$ 1.800          | 0.32 $\pm$ 5.000           | 0.2 $\pm$ 1.000        | 0.01 $\pm$ 0.100     | 24.0 $\pm$ 1.600          | 1.10 $\pm$ 2.000         | 0.715 $\pm$ 1.000        | 1.1 $\pm$ 2.000      |
| 1                                     | 703 Q176420         | 14 19990525   | 0.23 $\pm$ 5.100       | 20.2 $\pm$ 20.000    | 28.4 $\pm$ 1.800          | 0.09 $\pm$ 5.000           | 0.2 $\pm$ 1.000        | -0.01 $\pm$ 0.100    | 23.9 $\pm$ 1.600          | 1.10 $\pm$ 2.000         | 0.603 $\pm$ 1.000        | 1.3 $\pm$ 2.000      |
| 1                                     | 710 Q176418         | 11 19990525   | 0.06 $\pm$ 5.000       | 8.4 $\pm$ 20.000     | 23.4 $\pm$ 1.800          | 0.10 $\pm$ 5.000           | 0.1 $\pm$ 1.000        | -0.01 $\pm$ 0.100    | 20.1 $\pm$ 1.500          | 0.80 $\pm$ 2.000         | 0.399 $\pm$ 1.000        | 0.1 $\pm$ 2.000      |
| 1                                     | 451 Q176417         | 11 19990525   | 0.06 $\pm$ 5.000       | 8.4 $\pm$ 20.000     | 23.4 $\pm$ 1.800          | 0.06 $\pm$ 5.000           | 0.1 $\pm$ 1.000        | -0.04 $\pm$ 0.100    | 20.4 $\pm$ 1.600          | 0.54 $\pm$ 2.000         | 0.399 $\pm$ 1.000        | 0.1 $\pm$ 2.000      |
| 1                                     | 452 Q176423         | 11 19990525   | 0.80 $\pm$ 5.000       | 3.8 $\pm$ 2.100      | 0.4 $\pm$ 1.000           | 0.12 $\pm$ 5.000           | 0.4 $\pm$ 1.000        | -0.06 $\pm$ 0.100    | 25.9 $\pm$ 2.000          | 0.45 $\pm$ 2.000         | 2.244 $\pm$ 1.000        | 1.9 $\pm$ 2.000      |
| 1                                     | 701 Q177429         | 11 19990602   | 3.30 $\pm$ 0.5         | 284.0 $\pm$ 4.5      | 461.2 $\pm$ 23.6          | 0.70 $\pm$ 0.5             | 3.4 $\pm$ 0.7          | 0.30 $\pm$ 0.1       | 78.6 $\pm$ 19.2           | 12.40 $\pm$ 2.1          | 6.700 $\pm$ 0.43         | 22.4 $\pm$ 1.2       |
| 1                                     | 702 Q177428         | 11 19990602   | 1.10 $\pm$ 0.5         | 23.0 $\pm$ 0.5       | 40.3 $\pm$ 3.8            | 0.30 $\pm$ 0.5             | 0.5 $\pm$ 0.1          | 0.06 $\pm$ 0.05      | 28.2 $\pm$ 1.6            | 1.700 $\pm$ 0.2          | 0.746 $\pm$ 0.07         | 3.6 $\pm$ 0.3        |
| 1                                     | 710 Q177427         | 11 19990602   | 1.00 $\pm$ 0.5         | 0.0 $\pm$ 0.5        | 11.8 $\pm$ 0.8            | 0.10 $\pm$ 0.5             | 0.5 $\pm$ 0.2          | 0.04 $\pm$ 0.05      | 23.9 $\pm$ 1.4            | 1.200 $\pm$ 0.2          | 0.395 $\pm$ 0.08         | 2.0 $\pm$ 0.2        |
| 1                                     | 451 Q177426         | 11 19990602   | 1.00 $\pm$ 0.5         | 0.0 $\pm$ 0.5        | 9.4 $\pm$ 0.6             | 0.10 $\pm$ 0.5             | 0.4 $\pm$ 0.1          | 0.07 $\pm$ 0.05      | 23.5 $\pm$ 1.9            | 1.000 $\pm$ 0.2          | 0.905 $\pm$ 0.05         | 44.6 $\pm$ 2.5       |
| 1                                     | 452 Q177424         | 14 19990602   | 0.00 $\pm$ 0.5         | 0.0 $\pm$ 0.5        | 0.8 $\pm$ 0.1             | 0.30 $\pm$ 0.5             | 0.2 $\pm$ 0.3          | 0.02 $\pm$ 0.05      | 20.2 $\pm$ 1.8            | 0.000 $\pm$ 0.2          | 0.220 $\pm$ 0.05         | 1.7 $\pm$ 0.7        |
| 1                                     | 452 Q177425         | 14 19990602   | 1.50 $\pm$ 0.5         | 2.0 $\pm$ 0.5        | 0.8 $\pm$ 0.1             | 0.10 $\pm$ 0.5             | 0.2 $\pm$ 0.3          | 0.04 $\pm$ 0.05      | 23.1 $\pm$ 1.7            | 0.000 $\pm$ 0.4          | 0.230 $\pm$ 0.05         | 1.9 $\pm$ 0.3        |
| 1                                     | 701 Q176420         | 14 19991013   | 1.00 $\pm$ 0.5         | 78.0 $\pm$ 0.5       | 41.4 $\pm$ 2.2            | 0.20 $\pm$ 0.5             | 0.3 $\pm$ 0.3          | 0.00 $\pm$ 0.05      | 30.2 $\pm$ 1.4            | 1.800 $\pm$ 0.2          | 0.605 $\pm$ 0.00         | 0.4 $\pm$ 0.4        |
| 1                                     | 703 Q176420         | 14 19991013   | 1.00 $\pm$ 0.5         | 78.0 $\pm$ 0.5       | 42.7 $\pm$ 2.3            | 0.20 $\pm$ 0.5             | 0.1 $\pm$ 0.2          | 0.04 $\pm$ 0.06      | 30.7 $\pm$ 1.6            | 2.100 $\pm$ 0.3          | 0.670 $\pm$ 0.00         | 5.5 $\pm$ 0.8        |
| 1                                     | 702 Q176427         | 11 19991013   | 0.60 $\pm$ 0.5         | 31.0 $\pm$ 0.8       | 7.7 $\pm$ 1.3             | 0.10 $\pm$ 0.5             | 0.7 $\pm$ 0.7          | 0.02 $\pm$ 0.05      | 21.1 $\pm$ 1.7            | 1.300 $\pm$ 0.3          | 0.386 $\pm$ 0.08         | 1.3 $\pm$ 0.3        |
| 1                                     | 710 Q176426         | 11 19991013   | 0.50 $\pm$ 0.5         | 9.0 $\pm$ 0.5        | 0.8 $\pm$ 0.1             | 0.20 $\pm$ 0.5             | 0.7 $\pm$ 0.7          | 0.00 $\pm$ 0.05      | 21.9 $\pm$ 1.3            | 0.600 $\pm$ 0.2          | 0.210 $\pm$ 0.05         | 1.1 $\pm$ 0.3        |
| 1                                     | 451 Q176425         | 11 19991013   | 0.50 $\pm$ 0.5         | 5.0 $\pm$ 0.5        | 0.8 $\pm$ 0.1             | 0.10 $\pm$ 0.5             | 0.7 $\pm$ 0.7          | -0.02 $\pm$ 0.05     | 21.6 $\pm$ 1.4            | 0.800 $\pm$ 0.2          | 0.290 $\pm$ 0.05         | 0.2 $\pm$ 0.2        |
| 1                                     | 452 Q176424         | 11 19991013   | 0.50 $\pm$ 0.5         | 4.0 $\pm$ 0.5        | 0.8 $\pm$ 0.1             | 0.20 $\pm$ 0.5             | 0.0 $\pm$ 0.8          | -0.02 $\pm$ 0.05     | 21.6 $\pm$ 1.5            | 0.300 $\pm$ 0.2          | 0.210 $\pm$ 0.05         | 0.0 $\pm$ 0.2        |
| <b>PIC RIVER</b>                      |                     |               |                        |                      |                           |                            |                        |                      |                           |                          |                          |                      |
| <b>Spring</b>                         |                     |               |                        |                      |                           |                            |                        |                      |                           |                          |                          |                      |
| 1                                     | 20 Q176410          | 14 19990519   | 0.09 $\pm$ 5.000       | 17.6 $\pm$ 50.000    | 1.3 $\pm$ 1.000           | 0.11 $\pm$ 5.000           | 0.1 $\pm$ 1.000        | -0.02 $\pm$ 0.100    | 21.2 $\pm$ 1.000          | 1.070 $\pm$ 2.000        | 0.278 $\pm$ 1.000        | 0.3 $\pm$ 2.000      |
| 1                                     | 20 Q176411          | 14 19990519   | 0.14 $\pm$ 5.000       | 26.4 $\pm$ 50.000    | 1.3 $\pm$ 1.000           | 0.10 $\pm$ 5.000           | 0.1 $\pm$ 1.000        | -0.02 $\pm$ 0.100    | 21.2 $\pm$ 1.000          | 1.000 $\pm$ 2.000        | 0.265 $\pm$ 1.000        | 2.0 $\pm$ 2.000      |
| 1                                     | 454 Q176413         | 11 19990519   | 0.30 $\pm$ 0.000       | 160.0 $\pm$ 52.000   | 10.0 $\pm$ 1.100          | 0.09 $\pm$ 5.000           | 0.2 $\pm$ 1.000        | 0.14 $\pm$ 0.500     | 21.6 $\pm$ 1.600          | 0.760 $\pm$ 2.000        | 0.652 $\pm$ 1.000        | 1.6 $\pm$ 2.000      |
| 1                                     | 457 Q176412         | 11 19990519   | 4.72 $\pm$ 5.000       | 230.0 $\pm$ 52.000   | 231.0 $\pm$ 17.000        | 0.70 $\pm$ 5.000           | 1.6 $\pm$ 1.000        | 0.09 $\pm$ 0.500     | 150.0 $\pm$ 15.000        | 11.000 $\pm$ 2.100       | 1.380 $\pm$ 1.000        | 1.8 $\pm$ 2.000      |
| 1                                     | 21 Q176414          | 11 19990519   | 0.05 $\pm$ 5.000       | 14.1 $\pm$ 20.000    | 1.0 $\pm$ 1.000           | 0.09 $\pm$ 5.000           | 0.1 $\pm$ 1.000        | -0.03 $\pm$ 0.100    | 19.6 $\pm$ 2.000          | 0.400 $\pm$ 2.000        | 0.280 $\pm$ 1.000        | 0.0 $\pm$ 2.000      |
| <b>Summer</b>                         |                     |               |                        |                      |                           |                            |                        |                      |                           |                          |                          |                      |
| 1                                     | 20 Q177444          | 11 19990605   | 1.00 $\pm$ 0.5         | 59.0 $\pm$ 0.5       | 4.1 $\pm$ 0.05            | 0.16 $\pm$ 0.5             | 0.5 $\pm$ 0.314        | 0.03 $\pm$ 0.05      | 21.9 $\pm$ 13.8           | 2.000 $\pm$ 0.26         | 0.305 $\pm$ 0.1          | 1.7 $\pm$ 0.322      |
| 1                                     | 453 Q177445         | 14 19990605   | 1.73 $\pm$ 0.5         | 262.0 $\pm$ 26.2     | 24.2 $\pm$ 2.47           | 0.23 $\pm$ 0.5             | 1.6 $\pm$ 0.30         | 0.14 $\pm$ 0.05      | 43.7 $\pm$ 3.7            | 10.000 $\pm$ 1.81        | 0.943 $\pm$ 0.1          | 2.9 $\pm$ 0.200      |
| 1                                     | 453 Q177446         | 14 19990605   | 0.02 $\pm$ 0.5         | 260.0 $\pm$ 26.9     | 24.2 $\pm$ 2.47           | 0.23 $\pm$ 0.5             | 1.3 $\pm$ 0.153        | 0.09 $\pm$ 0.05      | 40.3 $\pm$ 3.3            | 12.000 $\pm$ 1.80        | 0.905 $\pm$ 0.1          | 2.8 $\pm$ 0.281      |
| 1                                     | 453 Q177447         | 0 19990605    | 0.02 $\pm$ 0.5         | 2.3 $\pm$ 0.5        | 0.1 $\pm$ 0.1             | 0.06 $\pm$ 0.5             | 0.6 $\pm$ 0.1          | 0.08 $\pm$ 0.05      | 10.1 $\pm$ 0.1            | 9.182 $\pm$ 0.337        | -0.018 $\pm$ 0.1         | 1.6 $\pm$ 0.272      |
| 1                                     | 21 Q177443          | 11 19990605   | 1.35 $\pm$ 0.5         | 5.7 $\pm$ 0.5        | 0.4 $\pm$ 0.1             | 0.16 $\pm$ 0.5             | 0.5 $\pm$ 0.162        | 0.07 $\pm$ 0.05      | 22.2 $\pm$ 1.27           | 0.883 $\pm$ 0.342        | 0.295 $\pm$ 0.1          | 2.1 $\pm$ 0.21       |
| <b>North of Pic. R. by Heaton Bay</b> |                     |               |                        |                      |                           |                            |                        |                      |                           |                          |                          |                      |
| 1                                     | 20 Q176437          | 14 19991015   | 1.00 $\pm$ 0.5         | 8.0 $\pm$ 0.5        | 0.1 $\pm$ 0.1             | 0.20 $\pm$ 0.5             | 0.1 $\pm$ 0.1          | 0.11 $\pm$ 0.05      | 24.8 $\pm$ 1.77           | 0.400 $\pm$ 0.4          | 0.305 $\pm$ 0.09         | 3.4 $\pm$ 0.3        |
| 1                                     | 20 Q176438          | 14 19991015   | 1.00 $\pm$ 0.5         | 8.0 $\pm$ 0.5        | 0.1 $\pm$ 0.1             | 0.20 $\pm$ 0.5             | 0.1 $\pm$ 0.1          | 0.09 $\pm$ 0.05      | 24.1 $\pm$ 1.6            | 0.300 $\pm$ 0.6          | 0.320 $\pm$ 0.05         | 1.9 $\pm$ 0.3        |
| 1                                     | 453 Q176439         | 11 19991015   | 1.40 $\pm$ 0.5         | 407.0 $\pm$ 0.5      | 25.3 $\pm$ 1.3            | 0.10 $\pm$ 0.5             | 0.4 $\pm$ 0.1          | 0.07 $\pm$ 0.05      | 30.7 $\pm$ 1.23           | 8.100 $\pm$ 0.9          | 0.600 $\pm$ 0.08         | 4.2 $\pm$ 0.3        |
| 1                                     | 454 Q176440         | 11 19991015   | 1.40 $\pm$ 0.5         | 300.0 $\pm$ 0.5      | 21.8 $\pm$ 2.2            | 0.10 $\pm$ 0.5             | 0.4 $\pm$ 0.1          | 0.07 $\pm$ 0.05      | 30.7 $\pm$ 1.23           | 8.100 $\pm$ 0.9          | 0.600 $\pm$ 0.08         | 4.2 $\pm$ 0.3        |
| 1                                     | 457 Q176441         | 11 19991015   | 1.50 $\pm$ 0.5         | 400.0 $\pm$ 0.5      | 25.1 $\pm$ 1.3            | 0.10 $\pm$ 0.5             | 0.5 $\pm$ 0.1          | 0.09 $\pm$ 0.05      | 30.7 $\pm$ 1.23           | 7.800 $\pm$ 1.1          | 0.620 $\pm$ 0.07         | 4.2 $\pm$ 0.3        |
| 1                                     | 21 Q176436          | 11 19991015   | 2.00 $\pm$ 0.5         | 16.0 $\pm$ 0.5       | 0.1 $\pm$ 0.1             | 0.20 $\pm$ 0.5             | 0.1 $\pm$ 0.1          | 0.11 $\pm$ 0.05      | 23.1 $\pm$ 1.6            | 0.300 $\pm$ 0.4          | 0.230 $\pm$ 0.05         | 2.1 $\pm$ 0.3        |
| <b>Wade (up)</b>                      |                     |               |                        |                      |                           |                            |                        |                      |                           |                          |                          |                      |
| 1                                     | 21 Q176436          | 11 19991015   | 2.00 $\pm$ 0.5         | 300.0 $\pm$ 0.5      | 0.1 $\pm$ 0.1             | 0.20 $\pm$ 0.5             | 0.1 $\pm$ 0.1          | 0.11 $\pm$ 0.05      | 23.1 $\pm$ 1.6            | 0.300 $\pm$ 0.4          | 0.230 $\pm$ 0.05         | 2.1 $\pm$ 0.3        |



Table 2 Metal concentrations in water samples collected from Lake Superior and Spanish River, 1999

| Station                                  | Station number | Date       | Latitude         | Longitude       | Altitude (m) | Depth (m)       | Water type   | Temperature (°C) | pH            | Dissolved oxygen (mg/L) | Calcium (mg/L) | Cadmium (mg/L) | Cobalt (mg/L) | Chromium (mg/L) | Copper (mg/L) | Iron (mg/L)  | Mercury (µg/L) |
|--|----------------|------------|------------------|-----------------|--------------|-----------------|--------------|------------------|---------------|-------------------------|----------------|----------------|---------------|-----------------|---------------|--------------|----------------|
| Spring                                   |                |            |                  |                 |              |                 |              |                  |               |                         |                |                |               |                 |               |              |                |
| Kam R. at Mission River                  | 1              | 1999/05/25 | 46° 13' 34.37" N | 93° 50' 52.5" W | 156 ± 15.8   | 0.0005 ± 0.0005 | 16.2 ± 1.62  | 0.011 ± 0.01     | 0.013 ± 0.05  | 0.060 ± 0.1             | 0.013 ± 0.05   | 0.013 ± 0.05   | 0.060 ± 0.1   | 8.7 ± 0.627     | 3.6 ± 0.5     | 740 ± 33.7   | 13.4           |
| Kam R. at Mission River                  | 1              | 1999/05/25 | 46° 13' 34.37" N | 93° 50' 52.5" W | 605 ± 40.5   | 0.0005 ± 0.0005 | 21.1 ± 2.11  | 0.029 ± 0.01     | 0.040 ± 0.06  | 0.374 ± 0.1             | 0.040 ± 0.06   | 0.040 ± 0.06   | 0.374 ± 0.1   | 3.4 ± 0.25      | 3.4 ± 0.25    | 900 ± 80.2   | 10.7           |
| Kam R. - north                           | 1              | 1999/05/25 | 46° 13' 34.37" N | 93° 50' 52.5" W | 244 ± 24.4   | 0.0005 ± 0.0005 | 16.7 ± 1.67  | 0.029 ± 0.01     | 0.011 ± 0.05  | 0.11 ± 0.05             | 0.011 ± 0.05   | 0.011 ± 0.05   | 0.11 ± 0.05   | 1.1 ± 0.25      | 1.1 ± 0.25    | 464 ± 44.4   | 6.8            |
| Mission River - north                    | 1              | 1999/05/25 | 46° 13' 34.37" N | 93° 50' 52.5" W | 509 ± 50.9   | 0.0005 ± 0.0005 | 21.2 ± 2.12  | 0.036 ± 0.01     | 0.070 ± 0.05  | 0.380 ± 0.1             | 0.070 ± 0.05   | 0.070 ± 0.05   | 0.380 ± 0.1   | 1.7 ± 0.25      | 1.7 ± 0.25    | 865 ± 86.5   | 13.4           |
| Mission River - south                    | 1              | 1999/05/25 | 46° 13' 34.37" N | 93° 50' 52.5" W | 275 ± 15.0   | 0.0005 ± 0.0005 | 21.0 ± 1.70  | 0.036 ± 0.01     | 0.036 ± 0.05  | 0.380 ± 0.1             | 0.036 ± 0.05   | 0.036 ± 0.05   | 0.380 ± 0.1   | 2.2 ± 0.500     | 2.2 ± 0.500   | 546 ± 59.000 | 5.8            |
| Mission River - south                    | 1              | 1999/05/25 | 46° 13' 34.37" N | 93° 50' 52.5" W | 358 ± 29.000 | 0.0005 ± 0.0005 | 19.8 ± 1.40  | 0.033 ± 0.01     | 0.043 ± 0.05  | 0.380 ± 0.1             | 0.043 ± 0.05   | 0.043 ± 0.05   | 0.380 ± 0.1   | 2.2 ± 0.500     | 2.2 ± 0.500   | 596 ± 69.000 | 7.3            |
| Between Mission & Kam River              | 1              | 1999/05/25 | 46° 13' 34.37" N | 93° 50' 52.5" W | 74 ± 7.37    | 0.0005 ± 0.0005 | 11.0 ± 1.1   | -0.004 ± 0.01    | 0.010 ± 0.05  | 0.078 ± 0.1             | 0.010 ± 0.05   | 0.010 ± 0.05   | 0.078 ± 0.1   | 1.1 ± 0.25      | 1.1 ± 0.25    | 116 ± 11.6   | 2.5            |
| North of Mission Bay Disposal            | 1              | 1999/05/25 | 46° 13' 34.37" N | 93° 50' 52.5" W | 64 ± 11.000  | 0.0005 ± 0.0005 | 15.4 ± 1.54  | 0.039 ± 0.01     | 0.056 ± 0.05  | 0.171 ± 0.1             | 0.039 ± 0.01   | 0.039 ± 0.01   | 0.171 ± 0.1   | 1.3 ± 0.25      | 1.3 ± 0.25    | 454 ± 45.4   | 7.5            |
| Provincial Paper (between the river bed) | 1              | 1999/05/25 | 46° 13' 34.37" N | 93° 50' 52.5" W | 13 ± 1.000   | 0.0005 ± 0.0005 | 13.1 ± 1.00  | 0.039 ± 0.01     | 0.020 ± 0.05  | 0.030 ± 0.1             | 0.039 ± 0.01   | 0.039 ± 0.01   | 0.030 ± 0.1   | 1.4 ± 0.500     | 1.4 ± 0.500   | 162 ± 50.000 | 8.2            |
| Die Abba (north of Lake Pt.)             | 1              | 1999/05/25 | 46° 13' 34.37" N | 93° 50' 52.5" W | 11.6 ± 1.200 | 0.0005 ± 0.0005 | 11.6 ± 1.200 | 0.023 ± 0.01     | 0.044 ± 0.05  | 0.080 ± 0.1             | 0.023 ± 0.01   | 0.023 ± 0.01   | 0.080 ± 0.1   | 1.4 ± 0.500     | 1.4 ± 0.500   | 40 ± 51.000  | 1.8            |
| North Entrance                           | 1              | 1999/05/25 | 46° 13' 34.37" N | 93° 50' 52.5" W | 12.7 ± 0.930 | 0.0005 ± 0.0005 | 12.7 ± 0.930 | 0.016 ± 0.01     | 0.017 ± 0.05  | 0.044 ± 0.1             | 0.016 ± 0.01   | 0.016 ± 0.01   | 0.044 ± 0.1   | 1.3 ± 0.500     | 1.3 ± 0.500   | 140 ± 51.000 | 3.2            |
| Bay                                      |                |            |                  |                 |              |                 |              |                  |               |                         |                |                |               |                 |               |              |                |
| Bay                                      | 1              | 1999/05/25 | 46° 13' 34.37" N | 93° 50' 52.5" W | 15.3 ± 1.53  | 0.0005 ± 0.0005 | 15.3 ± 1.53  | 0.011 ± 0.01     | 0.037 ± 0.05  | 0.134 ± 0.1             | 0.011 ± 0.01   | 0.011 ± 0.01   | 0.134 ± 0.1   | 2.1 ± 0.25      | 2.1 ± 0.25    | 203 ± 20.3   | 4.8            |
| Kam R. at Mission River                  | 1              | 1999/05/25 | 46° 13' 34.37" N | 93° 50' 52.5" W | 77 ± 7.65    | 0.0005 ± 0.0005 | 13.4 ± 1.34  | -0.002 ± 0.01    | 0.039 ± 0.05  | 0.086 ± 0.1             | 0.039 ± 0.05   | 0.039 ± 0.05   | 0.086 ± 0.1   | 1.5 ± 0.25      | 1.5 ± 0.25    | 112 ± 11.2   | 4.3            |
| Kam R. - north                           | 1              | 1999/05/25 | 46° 13' 34.37" N | 93° 50' 52.5" W | 112 ± 11.2   | 0.0005 ± 0.0005 | 15.8 ± 1.58  | 0.015 ± 0.01     | 0.042 ± 0.05  | 0.147 ± 0.1             | 0.015 ± 0.01   | 0.015 ± 0.01   | 0.147 ± 0.1   | 1.4 ± 0.25      | 1.4 ± 0.25    | 204 ± 20.4   | 3.6            |
| Mission River - north                    | 1              | 1999/05/25 | 46° 13' 34.37" N | 93° 50' 52.5" W | 82 ± 8.2     | 0.0005 ± 0.0005 | 14.3 ± 1.43  | 0.015 ± 0.01     | 0.042 ± 0.05  | 0.147 ± 0.1             | 0.015 ± 0.01   | 0.015 ± 0.01   | 0.147 ± 0.1   | 1.4 ± 0.25      | 1.4 ± 0.25    | 140 ± 14.0   | 2.3            |
| Mission River - south                    | 1              | 1999/05/25 | 46° 13' 34.37" N | 93° 50' 52.5" W | 48 ± 5.03    | 0.0005 ± 0.0005 | 11.5 ± 1.15  | 0.011 ± 0.01     | 0.042 ± 0.05  | 0.086 ± 0.1             | 0.011 ± 0.01   | 0.011 ± 0.01   | 0.086 ± 0.1   | 1.7 ± 0.25      | 1.7 ± 0.25    | 77 ± 7.73    | 2.9            |
| Mission River - south                    | 1              | 1999/05/25 | 46° 13' 34.37" N | 93° 50' 52.5" W | 48 ± 5.03    | 0.0005 ± 0.0005 | 11.5 ± 1.15  | 0.011 ± 0.01     | 0.042 ± 0.05  | 0.086 ± 0.1             | 0.011 ± 0.01   | 0.011 ± 0.01   | 0.086 ± 0.1   | 1.7 ± 0.25      | 1.7 ± 0.25    | 77 ± 7.73    | 2.9            |
| Between Mission & Kam River              | 1              | 1999/05/25 | 46° 13' 34.37" N | 93° 50' 52.5" W | 54 ± 5.38    | 0.0005 ± 0.0005 | 12.0 ± 1.2   | 0.008 ± 0.01     | 0.040 ± 0.05  | 0.094 ± 0.1             | 0.008 ± 0.01   | 0.008 ± 0.01   | 0.094 ± 0.1   | 1.6 ± 0.25      | 1.6 ± 0.25    | 78 ± 7.5     | 3.9            |
| North of Mission Bay Disposal            | 1              | 1999/05/25 | 46° 13' 34.37" N | 93° 50' 52.5" W | 49 ± 5.28    | 0.0005 ± 0.0005 | 12.0 ± 1.2   | 0.008 ± 0.01     | 0.040 ± 0.05  | 0.094 ± 0.1             | 0.008 ± 0.01   | 0.008 ± 0.01   | 0.094 ± 0.1   | 1.6 ± 0.25      | 1.6 ± 0.25    | 78 ± 7.5     | 3.9            |
| Provincial Paper (between the river bed) | 1              | 1999/05/25 | 46° 13' 34.37" N | 93° 50' 52.5" W | 56 ± 5.53    | 0.0005 ± 0.0005 | 12.0 ± 1.2   | -0.005 ± 0.01    | 0.045 ± 0.05  | 0.042 ± 0.1             | 0.045 ± 0.05   | 0.045 ± 0.05   | 0.042 ± 0.1   | 1.9 ± 0.25      | 1.9 ± 0.25    | 64 ± 6.5     | 2.9            |
| Die Abba (north of Lake Pt.)             | 1              | 1999/05/25 | 46° 13' 34.37" N | 93° 50' 52.5" W | 18 ± 3.56    | 0.0005 ± 0.0005 | 10.5 ± 1.05  | -0.010 ± 0.01    | 0.025 ± 0.05  | 0.031 ± 0.1             | 0.025 ± 0.05   | 0.025 ± 0.05   | 0.031 ± 0.1   | 2.2 ± 0.25      | 2.2 ± 0.25    | 68 ± 7.8     | 14.0           |
| North Entrance                           | 1              | 1999/05/25 | 46° 13' 34.37" N | 93° 50' 52.5" W | 30 ± 3.44    | 0.0005 ± 0.0005 | 11.5 ± 1.15  | -0.015 ± 0.01    | 0.033 ± 0.05  | 0.035 ± 0.1             | 0.033 ± 0.05   | 0.033 ± 0.05   | 0.035 ± 0.1   | 1.6 ± 0.25      | 1.6 ± 0.25    | 48 ± 7.84    | 3.2            |
| Full                                     |                |            |                  |                 |              |                 |              |                  |               |                         |                |                |               |                 |               |              |                |
| Full                                     | 1              | 1999/05/25 | 46° 13' 34.37" N | 93° 50' 52.5" W | 35 ± 1.9     | 0.0005 ± 0.0005 | 20.1 ± 1.24  | 0.000 ± 0.01     | 0.020 ± 0.06  | 0.300 ± 0.1             | 0.020 ± 0.06   | 0.020 ± 0.06   | 0.300 ± 0.1   | 2.4 ± 0.25      | 2.4 ± 0.25    | 544 ± 28     | 5.6            |
| Kam R. at Mission River                  | 1              | 1999/05/25 | 46° 13' 34.37" N | 93° 50' 52.5" W | 139 ± 10     | 0.0005 ± 0.0005 | 16.6 ± 1.16  | 0.000 ± 0.01     | 0.030 ± 0.06  | 0.100 ± 0.1             | 0.030 ± 0.06   | 0.030 ± 0.06   | 0.100 ± 0.1   | 2.0 ± 0.25      | 2.0 ± 0.25    | 219 ± 16     | 2.9            |
| Kam R. - north                           | 1              | 1999/05/25 | 46° 13' 34.37" N | 93° 50' 52.5" W | 20 ± 1.1     | 0.0005 ± 0.0005 | 20.2 ± 1.1   | 0.000 ± 0.01     | 0.030 ± 0.06  | 0.300 ± 0.1             | 0.030 ± 0.06   | 0.030 ± 0.06   | 0.300 ± 0.1   | 2.0 ± 0.25      | 2.0 ± 0.25    | 550 ± 36     | 5.9            |
| Mission River - north                    | 1              | 1999/05/25 | 46° 13' 34.37" N | 93° 50' 52.5" W | 139 ± 10     | 0.0005 ± 0.0005 | 14.8 ± 0.98  | 0.000 ± 0.01     | 0.040 ± 0.07  | 0.100 ± 0.1             | 0.040 ± 0.07   | 0.040 ± 0.07   | 0.100 ± 0.1   | 2.2 ± 0.25      | 2.2 ± 0.25    | 281 ± 15     | 2.7            |
| Mission River - south                    | 1              | 1999/05/25 | 46° 13' 34.37" N | 93° 50' 52.5" W | 294 ± 1.8    | 0.0005 ± 0.0005 | 19.3 ± 1.19  | 0.000 ± 0.01     | 0.050 ± 0.05  | 0.300 ± 0.1             | 0.050 ± 0.05   | 0.050 ± 0.05   | 0.300 ± 0.1   | 2.4 ± 0.25      | 2.4 ± 0.25    | 511 ± 28     | 5.3            |
| Between Mission & Kam River              | 1              | 1999/05/25 | 46° 13' 34.37" N | 93° 50' 52.5" W | 46 ± 2       | 0.0005 ± 0.0005 | 19.3 ± 1.19  | 0.000 ± 0.01     | 0.040 ± 0.05  | 0.300 ± 0.1             | 0.040 ± 0.05   | 0.040 ± 0.05   | 0.300 ± 0.1   | 2.3 ± 0.25      | 2.3 ± 0.25    | 509 ± 40     | 5.5            |
| North of Mission Bay Disposal            | 1              | 1999/05/25 | 46° 13' 34.37" N | 93° 50' 52.5" W | 46 ± 2       | 0.0005 ± 0.0005 | 12.1 ± 0.68  | 0.000 ± 0.01     | 0.030 ± 0.07  | 0.000 ± 0.1             | 0.030 ± 0.07   | 0.030 ± 0.07   | 0.000 ± 0.1   | 1.8 ± 0.25      | 1.8 ± 0.25    | 98 ± 6       | 1.0            |
| Provincial Paper (between the river bed) | 1              | 1999/05/25 | 46° 13' 34.37" N | 93° 50' 52.5" W | 51 ± 5       | 0.0005 ± 0.0005 | 12.1 ± 0.78  | 0.000 ± 0.01     | 0.060 ± 0.05  | 0.100 ± 0.1             | 0.060 ± 0.05   | 0.060 ± 0.05   | 0.100 ± 0.1   | 1.0 ± 0.25      | 1.0 ± 0.25    | 183 ± 15     | 1.4            |
| Die Abba (north of Lake Pt.)             | 1              | 1999/05/25 | 46° 13' 34.37" N | 93° 50' 52.5" W | 54 ± 3       | 0.0005 ± 0.0005 | 10.4 ± 0.58  | 0.000 ± 0.01     | 0.030 ± 0.06  | 0.100 ± 0.1             | 0.030 ± 0.06   | 0.030 ± 0.06   | 0.100 ± 0.1   | 2.5 ± 0.25      | 2.5 ± 0.25    | 80 ± 5       | 11.8           |
| North Entrance                           | 1              | 1999/05/25 | 46° 13' 34.37" N | 93° 50' 52.5" W | 19 ± 2       | 0.0005 ± 0.0005 | 9.3 ± 0.53   | 0.000 ± 0.01     | 0.000 ± 0.06  | 0.000 ± 0.1             | 0.000 ± 0.06   | 0.000 ± 0.06   | 0.000 ± 0.1   | 1.3 ± 0.25      | 1.3 ± 0.25    | 22 ± 5       | 0.1 ± 7        |
| Partial                                  |                |            |                  |                 |              |                 |              |                  |               |                         |                |                |               |                 |               |              |                |
| Partial                                  | 1              | 1999/05/25 | 46° 13' 34.37" N | 93° 50' 52.5" W | 34 ± 4       | 0.0005 ± 0.0005 | 10.3 ± 0.54  | 0.000 ± 0.01     | 0.023 ± 0.06  | 0.000 ± 0.1             | 0.023 ± 0.06   | 0.023 ± 0.06   | 0.000 ± 0.1   | 1.8 ± 0.25      | 1.8 ± 0.25    | 59 ± 13      | 1.3            |
| Pininsula Harbour                        |                |            |                  |                 |              |                 |              |                  |               |                         |                |                |               |                 |               |              |                |
| Spring                                   | 1              | 1999/05/17 | 46° 13' 34.37" N | 93° 50' 52.5" W | 4 ± 16.000   | 0.0005 ± 0.0005 | 9.7 ± 0.700  | 0.020 ± 0.01     | 0.017 ± 0.10  | 0.024 ± 0.1             | 0.020 ± 0.01   | 0.020 ± 0.01   | 0.024 ± 0.1   | 1.6 ± 0.500     | 1.6 ± 0.500   | 2 ± 50.000   | 3.0            |
| Jackson Cove - Near wharf                | 1              | 1999/05/17 | 46° 13' 34.37" N | 93° 50' 52.5" W | 8 ± 16.000   | 0.0005 ± 0.0005 | 10.0 ± 0.850 | 0.002 ± 0.01     | -0.006 ± 0.10 | 0.043 ± 0.1             | 0.002 ± 0.01   | 0.002 ± 0.01   | 0.043 ± 0.1   | 1.4 ± 0.500     | 1.4 ± 0.500   | 2 ± 50.000   | 2.2            |
| Jackson Cove - Near wharf                | 1              | 1999/05/17 | 46° 13' 34.37" N | 93° 50' 52.5" W | 8 ± 16.000   | 0.0005 ± 0.0005 | 10.0 ± 0.850 | 0.002 ± 0.01     | -0.006 ± 0.10 | 0.043 ± 0.1             | 0.002 ± 0.01   | 0.002 ± 0.01   | 0.043 ± 0.1   | 1.4 ± 0.500     | 1.4 ± 0.500   | 2 ± 50.000   | 2.2            |
| Jackson Cove - Near wharf                | 1              | 1999/05/17 | 46° 13' 34.37" N | 93° 50' 52.5" W | 8 ± 16.000   | 0.0005 ± 0.0005 | 10.0 ± 0.850 | 0.002 ± 0.01     | -0.006 ± 0.10 | 0.043 ± 0.1             | 0.002 ± 0.01   | 0.002 ± 0.01   | 0.043 ± 0.1   | 1.4 ± 0.500     | 1.4 ± 0.500   | 2 ± 50.000   | 2.2            |
| Upstream - near ml discharge pt          | 1              | 1999/05/17 | 46° 13' 34.37" N | 93° 50' 52.5" W | 16 ± 10.000  | 0.0005 ± 0.0005 | 9.7 ± 0.740  | 0.004 ± 0.01     | -0.041 ± 0.10 | 0.019 ± 0.1             | 0.004 ± 0.01   | 0.004 ± 0.01   | 0.019 ± 0.1   | 1.7 ± 0.500     | 1.7 ± 0.500   | 2 ± 50.000   | 1.9            |
| Upstream - near ml discharge pt          | 1              | 1999/05/17 | 46° 13' 34.37" N | 93° 50' 52.5" W | 16 ± 10.000  | 0.0005 ± 0.0005 | 9.7 ± 0.740  | 0.004 ± 0.01     | -0.041 ± 0.10 | 0.019 ± 0.1             | 0.004 ± 0.01   | 0.004 ± 0.01   | 0.019 ± 0.1   | 1.7 ± 0.500     | 1.7 ± 0.500   | 2 ± 50.000   | 1.9            |
| 500 m south of STP                       | 1              | 1999/05/17 | 46° 13' 34.37" N | 93° 50' 52.5" W | 8 ± 16.000   | 0.0005 ± 0.0005 | 9.6 ± 0.740  | 0.001 ± 0.01     | -0.023 ± 0.10 | 0.022 ± 0.1             | 0.001 ± 0.01   | 0.001 ± 0.01   | 0.022 ± 0.1   | 1.6 ± 0.500     | 1.6 ± 0.500   | 2 ± 50.000   | 1.1            |
| Summer                                   | 1              | 1999/05/17 | 46° 13' 34.37" N | 93° 50' 52.5" W | 8 ± 16.000   | 0.0005 ± 0.0005 | 9.6 ± 0.740  | 0.001 ± 0.01     | -0.023 ± 0.10 | 0.022 ± 0.1             | 0.001 ± 0.01   | 0.001 ± 0.01   | 0.022 ± 0.1   | 1.6 ± 0.500     | 1.6 ± 0.500   | 2 ± 50.000   | 1.1            |
| Jackson Cove - Near wharf                | 1              | 1999/05/17 | 46° 13' 34.37" N | 93° 50' 52.5" W | 8 ± 16.000   | 0.0005 ± 0.0005 | 10.0 ± 0.737 | 0.007 ± 0.01     | 0.034 ± 0.05  | 0.012 ± 0.1             | 0.007 ± 0.01   | 0.007 ± 0.01   | 0.012 ± 0.1   | 2.0 ± 0.25      | 2.0 ± 0.25    | 10 ± 5       | 1.1            |
| Jackson Cove - Near wharf                | 1              | 1999/05/17 | 46° 13' 34.37" N | 93° 50' 52.5" W | 8 ± 16.000   | 0.0005 ± 0.0005 | 10.0 ± 0.737 | 0.007 ± 0.01     | 0.            |                         |                |                |               |                 |               |              |                |







Table 3: Metal concentrations in sediment collected from Lake Superior and the Spanish River, 1999

| Station Description                      | Station Number | Date<br>YYYYMMDD | SMP<br>TYPE | Field<br>Sample No | Sample<br>Depth (m) | Aluminum<br>ug/g | Arsenic<br>ug/g | Cadmium<br>ug/g | Chromium<br>ug/g | Copper<br>ug/g | Iron<br>ug/g | Mercury<br>ug/g | Manganese<br>ug/g | Nickel<br>ug/g | Lead<br>ug/g | Zinc<br>ug/g |
|--|----------------|------------------|-------------|--------------------|---------------------|------------------|-----------------|-----------------|------------------|----------------|--------------|-----------------|-------------------|----------------|--------------|--------------|
| <b>Spanish River</b>                     |                |                  |             |                    |                     |                  |                 |                 |                  |                |              |                 |                   |                |              |              |
| Mouth of Spanish River                   | 14.1.400       | 19990810         | S5          | GL97680            | 2.2                 | 5300             | 0.7 <T          | 0.3 <W          | 12               | 7              | 8400         | 0.01 <W         | 390               | 41             | 7 <T         | 35           |
|  | 14.1.400       | 19990810         | S1          | GL97681            | 2.1                 | 5300             | 0.5 <T          | 0.2 <W          | 10               | 5              | 7900         | 0.01 <W         | 200               | 38             | 6 <T         | 34           |
|  | 14.1.400       | 19990810         | S1          | GL97682            | 0.2                 | 5300             | 0.7 <T          | 0.3 <W          | 10               | 5              | 8600         | 0.01 <W         | 270               | 36             | 6 <T         | 38           |
| Inner Station                            | 14.1.39        | 19990811         | S1          | GL97683            | 9.8                 | 14000            | 0.8 <T          | 0.8 <T          | 44               | 42             | 25000        | 0.05            | 670               | 150**          | 22           | 120          |
|  | 14.1.39        | 19990811         | S1          | GL97684            | 9.8                 | 14000            | 0.7 <T          | 0.7 <T          | 43               | 42             | 24000        | 0.05            | 600               | 140**          | 21           | 110          |
|  | 14.1.39        | 19990811         | S1          | GL97685            | 9.8                 | 13000            | 0.7 <T          | 0.7 <T          | 43               | 44             | 24000        | 0.05            | 780               | 140**          | 21           | 110          |
|  | 14.1.39        | 19990811         | S1          | GL97686            | 9.8                 | 14000            | 0.7 <T          | 0.7 <T          | 44               | 42             | 25000        | 0.04 <T         | 800               | 140**          | 20           | 110          |
|  | 14.1.39        | 19990811         | S1          | GL97687            | 9.7                 | 14000            | 0.8 <T          | 0.8 <T          | 44               | 42             | 25000        | 0.05            | 890               | 140**          | 21           | 110          |
| Whaleback Channel                        | 14.1.401       | 19990810         | S5          | GL97688            | 2.2                 | 21000            | 1.0             | 1.6             | 65               | 65             | 38000        | 0.11            | 3500**            | 450**          | 51           | 220          |
|  | 14.1.401       | 19990810         | S1          | GL97689            | 2.2                 | 21000            | 1.0             | 1.6             | 63               | 100            | 40000**      | 0.10            | 3200**            | 540**          | 59           | 250          |
|  | 14.1.401       | 19990810         | S1          | GL97690            | 2.2                 | 21000            | 1.0             | 1.6             | 63               | 120**          | 40000**      | 0.07            | 3200**            | 590**          | 67           | 250          |
|  | 14.1.401       | 19990810         | S1          | GL97691            | 2.2                 | 21000            | 1.0             | 1.6             | 63               | 120**          | 40000**      | 0.11            | 4200**            | 610            | 80           | 250          |
|  | 14.1.401       | 19990810         | S1          | GL97692            | 1.9                 | 24000            | 2.0             | 3.2             | 75               | 160**          | 46000**      | 0.16            | 5000**            | 840**          | 98           | 250          |
| Whaleback Channel (near Greenway Island) | 14.1.209       | 19990810         | S1          | GL97693            | 14.9                | 24000            | 2.0             | 3.2             | 75               | 160**          | 46000**      | 0.16            | 5000**            | 840**          | 98           | 250          |
|  | 14.1.209       | 19990810         | S1          | GL97694            | 14.9                | 24000            | 2.0             | 3.2             | 75               | 160**          | 46000**      | 0.16            | 5000**            | 840**          | 98           | 250          |
|  | 14.1.209       | 19990810         | S1          | GL97695            | 15.6                | 25000            | 14.0**          | 3.3             | 71               | 160**          | 47000**      | 0.16            | 5000**            | 840**          | 98           | 250          |
| Aird Bay                                 | 14.1.402       | 19990810         | S1          | GL97696            | 8.1                 | 18000            | 13.0            | 1.4             | 57               | 87             | 42000**      | 0.01 <W         | 1200**            | 380**          | 46           | 250          |
|  | 14.1.402       | 19990810         | S1          | GL97697            | 8.1                 | 18000            | 13.0            | 1.4             | 57               | 86             | 42000**      | 0.01 <W         | 1300**            | 370**          | 45           | 250          |
|  | 14.1.402       | 19990810         | S1          | GL97698            | 8.1                 | 18000            | 13.0            | 1.4             | 57               | 86             | 42000**      | 0.01 <W         | 1300**            | 380**          | 47           | 250          |
|  | 14.1.402       | 19990810         | S5          | GL97699            | 8.1                 | 19000            | 16.0            | 1.6             | 57               | 86             | 43000**      | 0.01 <W         | 1300**            | 390**          | 47           | 250          |
| Near Shanty Island                       | 14.1.402       | 19990810         | S5          | GL97700            | 11.7                | 16000            | 14.0            | 1.4             | 56               | 90             | 43000**      | 0.01 <W         | 1300**            | 390**          | 47           | 250          |
|  | 14.1.402       | 19990810         | S1          | GL97701            | 11.7                | 16000            | 14.0            | 1.4             | 48               | 53             | 28000        | 0.01 <W         | 1300**            | 200**          | 24           | 250          |
|  | 14.1.403       | 19990810         | S1          | GL97702            | 11.9                | 16000            | 4.2             | 1.1             | 48               | 52             | 28000        | 0.01 <W         | 1200**            | 200**          | 25           | 250          |
|  | 14.1.403       | 19990810         | S1          | GL97703            | 12.2                | 16000            | 4.5             | 1.1             | 49               | 54             | 28000        | 0.01 <W         | 2800**            | 460**          | 82           | 250          |
| Near Lina Island                         | 14.1.404       | 19990810         | S1          | GL97704            | 33.7                | 20000            | 16.0            | 2.3             | 59               | 88             | 35000        | 0.01 <W         | 3400**            | 450**          | 80           | 250          |
|  | 14.1.404       | 19990810         | S1          | GL97705            | 33.3                | 20000            | 19.0            | 2.6             | 58               | 84             | 35000        | 0.01 <W         | 3400**            | 450**          | 80           | 250          |
|  | 14.1.404       | 19990810         | S1          | GL97706            | 33.3                | 20000            | 19.0            | 2.6             | 58               | 84             | 35000        | 0.01 <W         | 3400**            | 450**          | 80           | 250          |
|  | 14.1.404       | 19990810         | S1          | GL97707            | 32.2                | 22000            | 20.0            | 2.3             | 59               | 82             | 37000        | 0.01 <W         | 4600**            | 460**          | 78           | 250          |
| <b>Nipigon Bay</b>                       |                |                  |             |                    |                     |                  |                 |                 |                  |                |              |                 |                   |                |              |              |
| Downstream of Nipigon B                  | 1.1.456        | 19990731         | S1          | GL97708            | 28.7                | 14500            | 2.4             | 0.2 <W          | 35               | 25             | 20000        | 0.02 <T         | 440               | 20             | 10           | 39           |
|  | 1.1.456        | 19990731         | S1          | GL97709            | 28.7                | 15000            | 2.2             | 0.2 <W          | 36               | 25             | 20000        | 0.01 <W         | 420               | 20             | 8 <T         | 38           |
|  | 1.1.456        | 19990731         | S1          | GL97710            | 28.7                | 15000            | 2.4             | 0.2 <W          | 36               | 25             | 20000        | 0.01 <W         | 420               | 20             | 8 <T         | 38           |
| Nipigon Bay - 30 m S of Mill outfall     | 1.1.459        | 19990731         | S1          | GL97711            | 2.8                 | 13000            | 1.6             | 0.2 <W          | 33               | 32             | 15000        | 0.02 <T         | 200               | 20             | 10           | 62           |
|  | 1.1.459        | 19990731         | S1          | GL97712            | 3.0                 | 13000            | 1.6             | 0.2 <W          | 33               | 32             | 15000        | 0.02 <T         | 200               | 20             | 10           | 62           |
|  | 1.1.459        | 19990731         | S5          | GL97713            | 3.0                 | 13000            | 1.6             | 0.2 <W          | 33               | 27             | 14000        | 0.02 <T         | 160               | 19             | 10           | 54           |
| Nipigon Bay - NW of Five Mile Pt         | 1.1.461        | 19990731         | S1          | GL97714            | 21.6                | 17000            | 4.5             | 0.3 <T          | 44               | 37             | 22000        | 0.034           | 360               | 26             | 12           | 65           |
|  | 1.1.461        | 19990731         | S1          | GL97715            | 21.6                | 17000            | 4.5             | 0.3 <T          | 44               | 37             | 22000        | 0.034           | 360               | 26             | 12           | 65           |
|  | 1.1.461        | 19990731         | S1          | GL97716            | 21.6                | 18000            | 3.8             | 0.3 <T          | 44               | 36             | 23000        | 0.06            | 370               | 26             | 14           | 65           |
|  | 1.1.461        | 19990731         | S5          | GL97717            | 21.6                | 17000            | 4.8             | 0.5 <T          | 45               | 40             | 22000        | 0.09            | 340               | 28             | 14           | 70           |
|  | 1.1.461        | 19990731         | S5          | GL97718            | 21.6                | 17000            | 4.8             | 0.5 <T          | 45               | 40             | 22000        | 0.09            | 340               | 28             | 14           | 70           |
| Nipigon Bay - Inner Station              | 1.1.286        | 19990731         | S1          | GL97719            | 14.0                | 24000            | 4.8             | 0.4 <T          | 44               | 39             | 22000        | 0.09            | 350               | 25             | 14           | 69           |
|  | 1.1.286        | 19990731         | S1          | GL97720            | 14.0                | 24000            | 4.8             | 0.4 <T          | 44               | 39             | 22000        | 0.09            | 350               | 25             | 14           | 69           |
|  | 1.1.286        | 19990731         | S1          | GL97721            | 14.0                | 24000            | 4.8             | 0.4 <T          | 44               | 39             | 22000        | 0.09            | 350               | 25             | 14           | 69           |
|  | 1.1.286        | 19990731         | S1          | GL97722            | 14.0                | 24000            | 4.8             | 0.4 <T          | 44               | 39             | 22000        | 0.09            | 350               | 25             | 14           | 69           |
|  | 1.1.286        | 19990731         | S1          | GL97723            | 14.0                | 24000            | 4.8             | 0.4 <T          | 44               | 39             | 22000        | 0.09            | 350               | 25             | 14           | 69           |
|  | 1.1.286        | 19990731         | S1          | GL97724            | 14.0                | 24000            | 4.8             | 0.4 <T          | 44               | 39             | 22000        | 0.09            | 350               | 25             | 14           | 69           |
|  | 1.1.286        | 19990731         | S1          | GL97725            | 14.0                | 24000            | 4.8             | 0.4 <T          | 44               | 39             | 22000        | 0.09            | 350               | 25             | 14           | 69           |
|  | 1.1.286        | 19990731         | S1          | GL97726            | 14.0                | 24000            | 4.8             | 0.4 <T          | 44               | 39             | 22000        | 0.09            | 350               | 25             | 14           | 69           |
|  | 1.1.286        | 19990731         | S1          | GL97727            | 14.0                | 24000            | 4.8             | 0.4 <T          | 44               | 39             | 22000        | 0.09            | 350               | 25             | 14           | 69           |
|  | 1.1.286        | 19990731         | S1          | GL97728            | 14.0                | 24000            | 4.8             | 0.4 <T          | 44               | 39             | 22000        | 0.09            | 350               | 25             | 14           | 69           |
|  | 1.1.286        | 19990731         | S1          | GL97729            | 14.0                | 24000            | 4.8             | 0.4 <T          | 44               | 39             | 22000        | 0.09            | 350               | 25             | 14           | 69           |
|  | 1.1.286        | 19990731         | S1          | GL97730            | 14.0                | 24000            | 4.8             | 0.4 <T          | 44               | 39             | 22000        | 0.09            | 350               | 25             | 14           | 69           |
|  | 1.1.286        | 19990731         | S1          | GL97731            | 14.0                | 24000            | 4.8             | 0.4 <T          | 44               | 39             | 22000        | 0.09            | 350               | 25             | 14           | 69           |
|  | 1.1.286        | 19990731         | S1          | GL97732            | 14.0                | 24000            | 4.8             | 0.4 <T          | 44               | 39             | 22000        | 0.09            | 350               | 25             | 14           | 69           |
|  | 1.1.286        | 19990731         | S1          | GL97733            | 14.0                | 24000            | 4.8             | 0.4 <T          | 44               | 39             | 22000        | 0.09            | 350               | 25             | 14           | 69           |
|  | 1.1.286        | 19990731         | S1          | GL97734            | 14.0                | 24000            | 4.8             | 0.4 <T          | 44               | 39             | 22000        | 0.09            | 350               | 25             | 14           | 69           |
|  | 1.1.286        | 19990731         | S1          | GL97735            | 14.0                | 24000            | 4.8             | 0.4 <T          | 44               | 39             | 22000        | 0.09            | 350               | 25             | 14           | 69           |
|  | 1.1.286        | 19990731         | S1          | GL97736            | 14.0                | 24000            | 4.8             | 0.4 <T          | 44               | 39             | 22000        | 0.09            | 350               | 25             | 14           | 69           |
|  | 1.1.286        | 19990731         | S1          | GL97737            | 14.0                | 24000            | 4.8             | 0.4 <T          | 44               | 39             | 22000        | 0.09            | 350               | 25             | 14           | 69           |
|  | 1.1.286        | 19990731         | S1          | GL97738            | 14.0                | 24000            | 4.8             | 0.4 <T          | 44               | 39             | 22000        | 0.09            | 350               | 25             | 14           | 69           |
|  | 1.1.286        | 19990731         | S1          | GL97739            | 14.0                | 24000            | 4.8             | 0.4 <T          | 44               | 39             | 22000        | 0.09            | 350               | 25             | 14           | 69           |
|  | 1.1.286        | 19990731         | S1          | GL97740            | 14.0                | 24000            | 4.8             | 0.4 <T          | 44               | 39             | 22000        | 0.09            | 350               | 25             | 14           | 69           |
|  | 1.1.286        | 19990731         | S1          | GL97741            | 14.0                | 24000            | 4.8             | 0.4 <T          | 44               | 39             | 22000        | 0.09            | 350               | 25             | 14           | 69           |
|  | 1.1.286        | 19990731         | S1          | GL97742            | 14.0                | 24000            | 4.8             | 0.4 <T          | 44               | 39             | 22000        | 0.09            | 350               | 25             | 14           | 69           |
|  | 1.1.286        | 19990731         | S1          | GL97743            | 14.0                | 24000            | 4.8             | 0.4 <T          | 44               | 39             | 22000        | 0.09            | 350               | 25             | 14           | 69           |
|  | 1.1.286        | 19990731         | S1          | GL97744            | 14.0                | 24000            | 4.8             | 0.4 <T          | 44               | 39             | 22000        | 0.09            | 350               | 25             | 14           | 69           |
|  | 1.1.286        | 19990731         | S1          | GL97745            | 14.0                | 24000            | 4.8             | 0.4 <T          | 44               | 39             | 22000        | 0.09            | 350               | 25             | 14           | 69           |
|  | 1.1.286        | 19990731         | S1          | GL97746            | 14.0                | 24000            | 4.8             | 0.4 <T          | 44               | 39             | 22000        | 0.09            | 350               | 25             | 14           | 69           |
|  | 1.1.286        | 19990731         | S1          | GL97747            | 14.0                | 24000            | 4.8             | 0.4 <T          | 44               | 39             | 22000        | 0.09            | 350               | 25             | 14           | 69           |
|  | 1.1.286        | 19990731         | S1          | GL97748            | 14.0                | 24000            | 4.8             | 0.4 <T          | 44               | 39             | 22000        | 0.09            | 350               | 25             | 14           | 69           |
|  | 1.1.286        | 19990731         | S1          | GL97749            | 14.0                | 24000            | 4.8             | 0.4 <T          | 44               | 39             | 22000        | 0.09            | 350               | 25             | 14           | 69           |
|  | 1.1.286        | 19990731         | S1          | GL97750            | 14.0                | 24000            | 4.8             | 0.4 <T          | 44               | 39             | 22000        | 0.09            | 350               | 25             | 14           | 69           |
|  | 1.1.286        | 19990731         | S1          | GL97751            | 14.0                | 24000            | 4.8             | 0.4 <T          | 44               | 39             | 22000        | 0.09            | 350               | 25             | 14           | 69           |
|  | 1.1.286        | 19990731         | S1          | GL97752            | 14.0                | 24000            | 4.8             | 0.4 <T          | 44               | 39             | 22000        | 0.09            | 350               | 25             | 14           | 69           |
|  | 1.1.286        | 19990731         | S1          | GL97753            | 14.0                | 24000            | 4.8             | 0.4 <T          | 44               | 39             | 22000        | 0.09            | 350               | 25             | 14           | 69           |
|  | 1.1.286        | 19990731         | S1          | GL97754            | 14.0                | 24000            | 4.8             | 0.4 <T          | 44               | 39             | 22000        | 0.09            | 350               | 25             | 14           | 69           |
|  | 1.1.286        | 19990731         | S1          | GL97755            | 14.0                | 24000            | 4.8             | 0.4 <T          | 44               | 39             | 22000        | 0.09            | 350               | 25             | 14           | 69           |
|  | 1.1.286        | 19990731         | S1          | GL97756            | 14                  |                  |                 |                 |                  |                |              |                 |                   |                |              |              |



Table 3: Metal concentrations in sediment collected from Lake Superior and the Spanish River, 1999

| Cation Description  | Station Number | Date YYYYMMDD | SMP TYPE | Field Sample No | Sample Depth (m) | Aluminum ug/g | Arsenic ug/g | Cadmium ug/g | Chromium ug/g | Copper ug/g | Iron ug/g | Mercury ug/g | Manganese ug/g | Nickel ug/g | Lead ug/g | Zinc ug/g |
|---|----------------|---------------|----------|-----------------|------------------|---------------|--------------|--------------|---------------|-------------|-----------|--------------|----------------|-------------|-----------|-----------|
| <b>Jackfish Bay</b>   |                |               |          |                 |                  |               |              |              |               |             |           |              |                |             |           |           |
| Blackbird Creek - mouth   | 1 1 701        | 19990602      | 51       | GL977644        | 1.8              | 5806          | 0.6 <T       | 0.2 <W       | 23            | 5           | 11000     | 0.04 <T      | 150            | 10          | 2 <W      | 35        |
|   | 1 1 701        | 19990602      | 51       | GL977645        | 1.8              | 6000          | 0.6 <T       | 0.2 <W       | 25            | 4 <T        | 10000     | 0.02 <T      | 160            | 11          | 5 <T      | 34        |
|   | 1 1 701        | 19990602      | 51       | GL977646        | 1.7              | 6100          | 0.6 <T       | 0.2 <W       | 21            | 4 <T        | 10000     | 0.02 <T      | 160            | 11          | 5 <T      | 34        |
| Moberly Bay   | 1 1 702        | 19990602      | 51       | GL977640        | 13.2             | 9700          | 1.8          | 1.1          | 55            | 28          | 16000     | 0.09         | 300            | 22          | 10        | 140       |
|   | 1 1 702        | 19990602      | 51       | GL977641        | 19.2             | 9800          | 2.0          | 1.0          | 54            | 28          | 16000     | 0.19         | 290            | 22          | 9 <T      | 140       |
|   | 1 1 702        | 19990602      | 51       | GL977642        | 19.2             | 10000         | 2.0          | 1.1          | 54            | 30          | 16000     | 0.10         | 290            | 23          | 11        | 140       |
|   | 1 1 702        | 19990602      | 51       | GL977643        | 19.2             | 10000         | 2.0          | 1.0          | 64            | 30          | 17000     | 0.06         | 300            | 23          | 10        | 140       |
| Downstream of Moberly Bay   | 1 1 710        | 19990602      | 51       | GL977637        | 34.2             | 12000         | 2.8          | 0.7 <T       | 62            | 27          | 22000     | 0.04 <T      | 440            | 17          | 11        | 66        |
|   | 1 1 710        | 19990602      | 51       | GL977638        | 31.5             | 8600          | 2.2          | 0.4 <T       | 39            | 17          | 18000     | 0.04 <T      | 440            | 17          | 11        | 66        |
|   | 1 1 710        | 19990602      | 51       | GL977639        | 35.0             | 9100          | 2.6          | 0.5 <T       | 46            | 16          | 20000     | 0.05         | 570            | 19          | 9 <T      | 72        |
| Jackfish Bay  | 1 1 451        | 19990731      | 51       | GL977631        | 41.2             | 11000         | 4.2          | 0.7 <T       | 47            | 11          | 22000     | 0.13         | 580            | 25          | 27        | 80        |
|   | 1 1 451        | 19990731      | 51       | GL977632        | 41.2             | 11000         | 4.2          | 0.7 <T       | 47            | 11          | 22000     | 0.13         | 580            | 25          | 27        | 80        |
|   | 1 1 451        | 19990731      | 51       | GL977635        | 41.2             | 14000         | 4.2          | 0.7 <T       | 48            | 38          | 23000     | 0.09         | 630            | 25          | 28        | 84        |
| Jackfish Bay - Index Station  | 1 1 268        | 19990603      | 55       | GL977621        | 18.4             | 7700          | 4.2          | 0.2 <W       | 41            | 11          | 20000     | 0.01 <W      | 460            | 18          | 11        | 39        |
|   | 1 1 268        | 19990603      | 55       | GL977622        | 18.1             | 8100          |              | 0.2 <W       | 42            | 11          | 20000     | 0.01 <W      | 600            | 19          | 11        | 42        |
|   | 1 1 268        | 19990603      | 51       | GL977623        | 18.6             | 7400          |              | 0.2 <W       | 36            | 11          | 20000     | 0.01 <W      | 420            | 17          | 7 <T      | 40        |
|   | 1 1 268        | 19990603      | 51       | GL977624        | 18.8             | 7400          |              | 0.3 <T       | 34            | 11          | 18000     | 0.01 <W      | 280            | 16          | 9 <T      | 37        |
|   | 1 1 268        | 19990603      | 51       | GL977625        | 18.9             | 7000          |              | 0.2 <W       | 37            | 9           | 20000     | 0.01 <W      | 230            | 14          | 6 <T      | 32        |
|   | 1 1 268        | 19991013      | 54       | GL953005        | 42.7             | 16000         |              | 1.5          | 110**         | 62          | 25000     | 0.10         | 1200**         | 55          | 22        | 120       |
| <b>Pic River</b>  |                |               |          |                 |                  |               |              |              |               |             |           |              |                |             |           |           |
| Pic River   | 1 1 20         | 19990605      | 51       | GL977600        | 11.2             | 8100          | 1.6          | 0.2 <W       | 23            | 10          | 17000     | 0.04 <T      | 320            | 11          | 3 <T      | 28        |
|   | 1 1 20         | 19990605      | 51       | GL977601        | 11.2             | 7700          | 1.7          | 0.2 <W       | 22            | 10          | 11000     | 0.01 <W      | 320            | 11          | 5 <T      | 28        |
|   | 1 1 20         | 19990605      | 51       | GL977602        | 11.2             | 8300          | 1.6          | 0.2 <W       | 24            | 10          | 11000     | 0.01 <W      | 330            | 11          | 9 <T      | 28        |
| Pic River - mouth   | 1 1 453        | 19990605      | 55       | GL977603        | 11.9             | 6200          | 1.4          | 0.4 <T       | 22            | 4 <T        | 14000     | 0.01 <W      | 200            | 10          | 4 <T      | 28        |
|   | 1 1 453        | 19990605      | 55       | GL977604        | 11.9             | 6100          | 1.3          | 0.2 <W       | 23            | 5           | 14000     | 0.01 <W      | 200            | 10          | 2 <W      | 20 <T     |
|   | 1 1 453        | 19990605      | 51       | GL977605        | 11.6             | 5500          | 1.2          | 0.2 <W       | 20            | 3 <T        | 11000     | 0.01 <W      | 180            | 9           | 3 <T      | 17 <T     |
| Pic River - South of mouth  | 1 1 453        | 19990605      | 51       | GL977606        | 11.6             | 6400          | 1.3          | 0.2 <W       | 21            | 4 <T        | 12000     | 0.01 <W      | 190            | 10          | 4 <T      | 19 <T     |
| Pic River - west of mouth   | 1 1 452        | 19991015      | 51       | GL955002        | 2.1              | 4600          | 1.6          | 0.2 <W       | 15            | 2           | 8000      | 0.01 <W      | 150            | 8           | 2 <W      | 15 <T     |
| <b>Lowest Effect Level (ug/g)</b>   |                |               |          |                 |                  |               |              |              |               |             |           |              |                |             |           |           |
| <b>Severe Effect Level (ug/g)</b>   |                |               |          |                 |                  |               |              |              |               |             |           |              |                |             |           |           |
| Background - Great Lakes  |                |               |          |                 |                  |               | 33.0         | 1.1          | 119           | 110         | 4%        | 0.39         | 460            | 19          | 31        | 139       |
| Background - Lake Superior pre-colonial sediment horizon - depositional basin, Mudoch et al. (1982) (n=1) |                |               |          |                 |                  |               | 4.2          | 0.4 <T       | 26            | 17.1        | 30.44     | 0.04 <T      | 24.4           | 20.5        | 6.9       | 137.1     |

<W no measurable response  
<T measurable trace amount, interpret with caution



Table 3: Metal concentrations in sediment collected from Lake Superior and the Spanish River, 1999

| Station Description                      | Station Number | TSS, mg/g | Total Phosphorus, mg/g | Barium, µg/g | Mercury, µg/g | Calcium, µg/g | Cadmium, µg/g | Magnesium, µg/g | Molybdenum, µg/g | Strontium, µg/g | Tarant, µg/g | Vanadium, µg/g | LOI, (mg/g) | TOC, (mg/g) | Gravel, % | Sand, % | Silt & Clay, % | Clay, % | Si, % | Sand, % | RMK |
|--|----------------|-----------|------------------------|--------------|---------------|---------------|---------------|-----------------|------------------|-----------------|--------------|----------------|-------------|-------------|-----------|---------|----------------|---------|-------|---------|-----|
| Spanish River                            |                |           |                        |              |               |               |               |                 |                  |                 |              |                |             |             |           |         |                |         |       |         |     |
| South of Spanish River                   | 14.1.400       | 0.1 <RW   | 0.28                   | 21           | 0.5 <RW       | 3100          | 8             | 2800            | 0.5 <RW          | 19              | 750          | 19             | 8           | 2 <T        | 0         | 87      | 13             |         |       |         |     |
|  | 14.1.400       | 1.8       | 0.20                   | 19           | 0.5 <RW       | 2700          | 8             | 2800            | 0.5 <RW          | 18              | 620          | 16             | 5           | 1 <RW       | 0         | 92      | 8              |         |       |         |     |
|  | 14.1.400       | 0.2 <T    | 0.28                   | 22           | 0.5 <RW       | 3200          | 9             | 2800            | 0.5 <RW          | 20              | 710          | 20             | 6           | 13          | 0         | 86      | 14             |         |       |         |     |
| Index Station                            | 14.1.39        | 0.6       | 0.94                   |              |               |               |               |                 |                  |                 |              |                |             | 15          |           |         |                | 23      | 77    | 1 <RW   |     |
|  | 14.1.39        | 0.5       | 0.84                   |              |               |               |               |                 |                  |                 |              |                |             | 16          |           |         |                | 22      | 75    | 2 <T    |     |
|  | 14.1.39        | 0.8       | 0.84                   |              |               |               |               |                 |                  |                 |              |                |             | 14          |           |         |                | 23      | 77    | 1 <RW   |     |
|  | 14.1.39        |           |                        |              |               |               |               |                 |                  |                 |              |                |             | 16          |           |         |                | 23      | 75    | 2 <T    |     |
|  | 14.1.39        |           |                        |              |               |               |               |                 |                  |                 |              |                |             | 14          |           |         |                | 23      | 75    | 2 <T    |     |
|  | 14.1.39        |           |                        |              |               |               |               |                 |                  |                 |              |                |             | 16          |           |         |                | 24      | 73    | 3 <T    |     |
| Whitesack Channel                        | 14.1.401       | 2.6       | 1.46                   | 210          | 0.8 <T        | 5000          | 57            | 9200            | 0.5 <RW          | 48              | 1400         | 70             | 67          | 28          | 2         | 47      | 51             |         |       |         |     |
|  | 14.1.401       | 0.8       | 1.20                   | 200          | 0.8 <T        | 7400          | 64            | 8400            | 0.5 <RW          | 44              | 1300         | 71             | 64          | 25          | 3         | 50      | 51             |         |       |         |     |
|  | 14.1.401       | 0.8       | 1.20                   | 200          | 0.8 <T        | 7700          | 68            | 9500            | 0.5 <RW          | 44              | 1400         | 71             | 63          | 25          | 3         | 48      | 48             |         |       |         |     |
| Whitesack Channel - near Greenway Island | 14.1.209       | 2.9       | 1.70                   | 250          | 1.0 <T        | 7400          | 88            | 10000           | 0.5 <RW          | 48              | 1400         | 79             | 63          | 25          | 2         | 54      | 44             |         |       |         |     |
|  | 14.1.209       | 2.3       | 1.70                   | 250          | 1.0 <T        | 8300          | 91            | 10000           | 0.5 <RW          | 51              | 1300         | 82             | 66          | 24          | 1         | 54      | 45             |         |       |         |     |
|  | 14.1.209       | 2.9       | 1.50                   | 260          | 1.0 <T        | 8000          | 46            | 8400            | 0.9 <T           | 44              | 1400         | 63             | 61          | 21          | 1         | 36      | 63             |         |       |         |     |
| Red Bay                                  | 14.1.402       | 2.2       | 0.84                   | 110          | 0.8 <T        | 7700          | 45            | 8400            | 0.5 <RW          | 42              | 1400         | 63             | 59          | 25          | 3         | 41      | 56             |         |       |         |     |
|  | 14.1.402       | 2.6       | 0.84                   | 110          | 0.8 <T        | 8100          | 46            | 8400            | 0.5 <RW          | 40              | 1300         | 63             | 59          | 25          | 1         | 37      | 62             |         |       |         |     |
|  | 14.1.402       | 2.9       | 1.00                   | 120          | 0.7 <T        | 7500          | 47            | 8400            | 0.5 <RW          | 42              | 1400         | 53             | 62          | 20          | 2         | 31      | 67             |         |       |         |     |
|  | 14.1.402       | 3.7       | 1.00                   | 120          | 0.7 <T        | 7500          | 28            | 7600            | 0.5 <RW          | 38              | 1200         | 51             | 48          | 20          | 2         | 24      | 74             |         |       |         |     |
| Near Sham Island                         | 14.1.403       | 0.6       | 0.98                   | 99           | 0.6 <T        | 7600          | 28            | 7600            | 0.5 <RW          | 38              | 1200         | 51             | 48          | 20          | 2         | 31      | 67             |         |       |         |     |
|  | 14.1.403       | 0.7       | 1.00                   | 100          | 0.6 <T        | 7200          | 28            | 7600            | 0.5 <RW          | 38              | 1200         | 51             | 48          | 20          | 2         | 31      | 67             |         |       |         |     |
|  | 14.1.403       | 0.9       | 1.00                   | 100          | 0.6 <T        | 7200          | 28            | 7600            | 0.5 <RW          | 38              | 1200         | 51             | 48          | 20          | 2         | 31      | 67             |         |       |         |     |
|  | 14.1.403       | 2.9       | 1.00                   | 100          | 0.6 <T        | 7200          | 28            | 7600            | 0.5 <RW          | 38              | 1200         | 51             | 48          | 20          | 2         | 31      | 67             |         |       |         |     |
| Near Little Detour                       | 14.1.404       | 2.1       | 0.84                   | 200          | 0.8 <T        | 7600          | 38            | 9200            | 0.6 <T           | 45              | 1100         | 65             | 74          | 26          | 1         | 35      | 44             |         |       |         |     |
|  | 14.1.404       | 2.1       | 0.84                   | 200          | 0.8 <T        | 7600          | 38            | 9200            | 0.6 <T           | 45              | 1100         | 65             | 74          | 26          | 1         | 35      | 44             |         |       |         |     |
|  | 14.1.404       | 1.2       | 0.84                   | 250          | 1.0 <T        | 8400          | 37            | 9800            | 1.2 <T           | 48              | 1100         | 68             | 78          | 33          | 1         | 54      | 45             |         |       |         |     |
| Nipigon Bay                              |                |           |                        |              |               |               |               |                 |                  |                 |              |                |             |             |           |         |                |         |       |         |     |
| Downstream of Nipigon #                  | 11.405         | 0.8       | 0.64                   | 57           | 0.5 <RW       | 47000         | 97            | 24000           | 0.5 <RW          | 40              | 1200         | 53             | 30          | 20          | 0         | 33      | 67             |         |       |         |     |
|  | 11.458         | 0.5       | 0.56                   | 53           | 0.5 <RW       | 46000         | 97            | 24000           | 0.5 <RW          | 42              | 1300         | 56             | 28          | 32          | 0         | 32      | 67             |         |       |         |     |
|  | 11.458         | 0.9       | 0.56                   | 54           | 0.5 <RW       | 46000         | 97            | 24000           | 0.5 <RW          | 42              | 1300         | 56             | 28          | 32          | 0         | 32      | 67             |         |       |         |     |
| Nipigon Bay - 30 m S of mill outfall     | 11.459         | 2.3       | 0.72                   | 41           | 0.5 <RW       | 16000         | 7             | 8500            | 0.5 <RW          | 26              | 970          | 48             | 220         | 120**       | 1         | 66      | 31             |         |       |         |     |
|  | 11.459         | 2.2       | 0.86                   | 39           | 0.5 <RW       | 14000         | 7             | 7800            | 0.5 <RW          | 25              | 920          | 46             | 240         | 120**       | 1         | 69      | 30             |         |       |         |     |
|  | 11.459         | 1.6       | 0.80                   | 32           | 0.5 <RW       | 12000         | 6             | 5000            | 0.5 <RW          | 22              | 790          | 41             | 340         | 190**       | 2         | 71      | 27             |         |       |         |     |
| Nipigon Bay - NM of Five Mile Pt         | 11.461         | 1.6       | 0.78                   | 69           | 0.5 <RW       | 30000         | 10            | 22000           | 0.5 <RW          | 33              | 1300         | 55             | 100         | 55          | 1         | 39      | 61             |         |       |         |     |
|  | 11.461         | 1.5       | 0.76                   | 73           | 0.5 <RW       | 32000         | 11            | 23000           | 0.5 <RW          | 35              | 1300         | 56             | 110         | 62          | 1         | 42      | 58             |         |       |         |     |
|  | 11.461         | 1.5       | 0.76                   | 67           | 0.5 <RW       | 28000         | 11            | 21000           | 0.5 <RW          | 33              | 1300         | 56             | 130         | 75          | 0         | 43      | 57             |         |       |         |     |
|  | 11.461         | 1.7       | 0.76                   | 69           | 0.5 <RW       | 28000         | 11            | 21000           | 0.5 <RW          | 34              | 1300         | 56             | 130         | 60          | 0         | 40      | 60             |         |       |         |     |
| Nipigon Bay - Index Station              | 11.465         | 0.7       | 0.72                   |              |               |               |               |                 |                  |                 |              |                |             | 13          |           |         |                | 36      | 63    | 1 <RW   |     |
|  | 11.465         | 0.7       | 0.72                   |              |               |               |               |                 |                  |                 |              |                |             | 10          |           |         |                | 37      | 63    | 1 <RW   |     |
|  | 11.465         | 0.6       | 0.64                   |              |               |               |               |                 |                  |                 |              |                |             | 12          |           |         |                | 36      | 64    | 1 <RW   |     |
|  | 11.286         | 0.6       | 0.64                   |              |               |               |               |                 |                  |                 |              |                |             | 14          |           |         |                | 39      | 61    | 1 <RW   |     |
|  | 11.286         |           |                        |              |               |               |               |                 |                  |                 |              |                |             | 10          |           |         |                | 37      | 63    | 1 <RW   |     |
| Nipigon Bay - West of Fro Island         | 11.869         | 3.7       | 0.94                   | 94           | 0.6 <T        | 34000         | 13            | 25000           | 0.5 <RW          | 40              | 1500         | 64             | 31          | 22          | 1         | 47      | 52             |         |       |         |     |
|  | 11.869         | 0.4 <T    | 0.48                   | 99           | 0.6 <T        | 34000         | 13            | 26000           | 0.5 <RW          | 42              | 1600         | 67             | 31          | 20          | 0         | 46      | 54             |         |       |         |     |
|  | 11.869         | 0.1 <RW   | 0.64                   | 96           | 0.6 <T        | 34000         | 13            | 26000           | 0.5 <RW          | 42              | 1600         | 66             | 28          | 10          | 1         | 50      | 49             |         |       |         |     |







**Table 3: Metal concentrations in sediment collected from Lake Superior and the Spanish River, 1999**

| Station Description  | Station Number                                   | Date     | UMP TYPE    | Field Sample No | Sample Depth (m) | Aluminum $\mu\text{g/g}$ | Arsenic $\mu\text{g/g}$ | Cadmium $\mu\text{g/g}$ | Chromium $\mu\text{g/g}$ | Copper $\mu\text{g/g}$ | Iron $\mu\text{g/g}$ | Mercury $\mu\text{g/g}$ | Manganese $\mu\text{g/g}$ | Nickel $\mu\text{g/g}$ | Lead $\mu\text{g/g}$ | Zinc $\mu\text{g/g}$ | TKN $\text{mg/g}$ |     |
|--|--|----------|-------------|-----------------|------------------|--------------------------|-------------------------|-------------------------|--------------------------|------------------------|----------------------|-------------------------|---------------------------|------------------------|----------------------|----------------------|-------------------|-----|
|  |  | YYYYMMDD |             |                 |                  |                          |                         |                         |                          |                        |                      |                         |                           |                        |                      |                      |                   |     |
| Thunder Bay<br>Kam 12 at Mission River   | 1  | 1802     | 19960726    | 55 GL97604      | 8.2              | 28000                    | 110                     | 0.5                     | <1                       | 56                     | 56                   | 45000                   |                           | 510                    | 38                   | 16                   | 13                |     |
|  | 1  | 1802     | 19960729    | 55 GL97605      | 8.2              | 24000                    | 70                      | 0.8                     | <1                       | 52                     | 53                   | 45000                   |                           | 580                    | 38                   | 15                   | 140               |     |
|  | 1  | 1802     | 19960729    | 55 GL97606      | 8.2              | 24000                    | 90                      | 0.8                     | <1                       | 52                     | 53                   | 45000                   |                           | 540                    | 38                   | 19                   | 140               |     |
|  | 1  | 1802     | 19960729    | 55 GL97607      | 8.1              | 21000                    | 3.7                     | 0.6                     | <1                       | 52                     | 54                   | 43000                   |                           | 500                    | 36                   | 17                   | 140               |     |
|  | 1  | 1802     | 19960728    | 55 GL97614      | 8.8              | 17000                    | 0.0                     | 0.3                     | <1                       | 38                     | 24                   | 37000                   |                           | 350                    | 26                   | 6                    | 41                |     |
|  | 1  | 1802     | 19960728    | 55 GL97615      | 9.1              | 15000                    | 4.0                     | 0.2                     | <1                       | 38                     | 23                   | 37000                   |                           | 330                    | 26                   | 9                    | 41                |     |
|  | 1  | 1802     | 19960728    | 55 GL97616      | 9.1              | 15000                    | 4.0                     | 0.2                     | <1                       | 38                     | 23                   | 37000                   |                           | 330                    | 26                   | 9                    | 41                |     |
|  | 1  | 1802     | 19960728    | 55 GL97617      | 9.1              | 15000                    | 4.0                     | 0.2                     | <1                       | 38                     | 23                   | 37000                   |                           | 330                    | 26                   | 9                    | 41                |     |
|  | 1  | 1802     | 19960728    | 55 GL97618      | 9.1              | 15000                    | 4.0                     | 0.2                     | <1                       | 38                     | 23                   | 37000                   |                           | 330                    | 26                   | 9                    | 41                |     |
|  | 1  | 1802     | 19960728    | 55 GL97619      | 9.1              | 15000                    | 4.0                     | 0.2                     | <1                       | 38                     | 23                   | 37000                   |                           | 330                    | 26                   | 9                    | 41                |     |
|  | 1  | 1802     | 19960728    | 55 GL97620      | 9.1              | 15000                    | 4.0                     | 0.2                     | <1                       | 38                     | 23                   | 37000                   |                           | 330                    | 26                   | 9                    | 41                |     |
|  | 1  | 1802     | 19960728    | 55 GL97621      | 9.1              | 15000                    | 4.0                     | 0.2                     | <1                       | 38                     | 23                   | 37000                   |                           | 330                    | 26                   | 9                    | 41                |     |
| McKellar River - mouth   | 1  | 1802     | 19960729    | 55 GL97629      | 8.1              | 20000                    | 6.8                     | 0.3                     | <1                       | 41                     | 31                   | 38000                   |                           | 480                    | 28                   | 13                   | 110               |     |
|  | 1  | 1802     | 19960729    | 55 GL97630      | 8.1              | 20000                    | 7.0                     | 0.3                     | <1                       | 41                     | 31                   | 38000                   |                           | 480                    | 28                   | 13                   | 110               |     |
|  | 1  | 1802     | 19960729    | 55 GL97631      | 8.1              | 15000                    | 5.3                     | 0.2                     | <1                       | 38                     | 15                   | 38000                   | 0.05                      | 430                    | 25                   | 6                    | 41                |     |
|  | 1  | 1802     | 19960729    | 55 GL97632      | 4.3              | 15000                    | 5.3                     | 0.2                     | <1                       | 38                     | 15                   | 38000                   | 0.04                      | 410                    | 24                   | 9                    | 41                |     |
|  | 1  | 1802     | 19960729    | 55 GL97633      | 4.3              | 15000                    | 5.3                     | 0.2                     | <1                       | 38                     | 15                   | 38000                   | 0.05                      | 410                    | 24                   | 9                    | 41                |     |
|  | 1  | 1802     | 19960729    | 55 GL97634      | 6.1              | 15000                    | 1.9                     | 0.2                     | <1                       | 30                     | 16                   | 28000                   | 0.05                      | 240                    | 20                   | 4                    | 41                |     |
|  | 1  | 1802     | 19960729    | 55 GL97635      | 6.2              | 18000                    | 2.8                     | 0.2                     | <1                       | 30                     | 18                   | 30000                   | 0.04                      | 260                    | 22                   | 7                    | 41                |     |
|  | 1  | 1802     | 19960729    | 55 GL97636      | 6.2              | 18000                    | 3.1                     | 0.2                     | <1                       | 30                     | 19                   | 30000                   | 0.05                      | 270                    | 24                   | 11                   | 41                |     |
|  | 1  | 1802     | 19960729    | 55 GL97637      | 2.7              | 8700                     | 1.4                     | 0.2                     | <1                       | 20                     | 4                    | 31000                   | 0.01                      | 240                    | 16                   | 7                    | 41                |     |
|  | 1  | 1802     | 19960729    | 55 GL97638      | 2.4              | 9100                     | 2.5                     | 0.4                     | <1                       | 41                     | 29                   | 3200                    | 0.40                      | 340                    | 21                   | 23                   | 69                |     |
|  | 1  | 1802     | 19960729    | 55 GL97639      | 2.4              | 13000                    | 1.6                     | 0.8                     | <1                       | 20                     | 38                   | 2300                    | 0.87                      | 275                    | 6                    | 24                   | 110               |     |
|  | 1  | 1802     | 19960729    | 55 GL97640      | 2.4              | 17000                    | 4.4                     | 1.5                     | 1.6                      | 65                     | 68                   | 7200                    | 5.5                       | 78                     | 20                   | 30                   | 170               |     |
| Wellcome Island - Index Station  | 1  | 1884     | 19960730    | 51 GL977601     | 17.1             | 27000                    |                         |                         | 1.2                      | 67                     | 68                   | 45000                   | 0.45                      | 780                    | 44                   | 35                   | 170               |     |
|  | 1  | 1884     | 19960730    | 51 GL977602     | 17.1             | 27000                    |                         |                         | 1.3                      | 65                     | 64                   | 45000                   | 0.45                      | 830                    | 43                   | 32                   | 160               |     |
|  | 1  | 1884     | 19960730    | 51 GL977603     | 17.2             | 24000                    |                         |                         | 0.8                      | 59                     | 56                   | 41000                   | 0.43                      | 730                    | 39                   | 28                   | 140               |     |
|  | 1  | 1884     | 19960730    | 51 GL977604     | 17.2             | 26000                    |                         |                         | 0.9                      | 64                     | 64                   | 41000                   | 0.50                      | 650                    | 43                   | 44                   | 160               |     |
|  | 1  | 1884     | 19960730    | 51 GL977605     | 17.1             | 26000                    |                         |                         | 1.4                      | 73                     | 69                   | 45000                   | 0.36                      | 700                    | 46                   | 34                   | 160               |     |
|  | Peninsula Harbour<br>Healey Cove - Index Station | 1        | 1269        | 19960804        | 51 GL977609      | 19                       | 10000                   |                         | 0.8                      | <1                     | 31                   | 31                      | 20000                     | 0.52                   | 380                  | 20                   | 13                | 73  |
|  |  | 1        | 1269        | 19960804        | 51 GL977627      | 19.3                     | 11000                   |                         | 0.8                      | <1                     | 46                   | 31                      | 20000                     | 0.76                   | 400                  | 20                   | 10                | 73  |
|  |  | 1        | 1269        | 19960804        | 51 GL977628      | 109.2                    | 10000                   |                         | 0.7                      | <1                     | 40                   | 30                      | 19000                     | 0.84                   | 350                  | 20                   | 11                | 73  |
|  |  | 1        | 1269        | 19960804        | 51 GL977629      | 19.3                     | 11000                   |                         | 0.8                      | <1                     | 42                   | 33                      | 20000                     | 0.68                   | 350                  | 21                   | 13                | 74  |
|  |  | 1        | 1269        | 19960804        | 51 GL977630      | 19.3                     | 10000                   |                         | 0.6                      | <1                     | 41                   | 29                      | 20000                     | 0.65                   | 330                  | 21                   | 13                | 72  |
|  |  | 1        | 1269        | 19960804        | 51 GL977634      | 8.7                      | 6900                    | 2.9                     | 0.4                      | <1                     | 39                   | 21                      | 16000                     | 17.0                   | 180                  | 21                   | 13                | 100 |
|  |  | 1        | 1276        | 19960804        | 51 GL977635      | 6.7                      | 6400                    | 2.9                     | 0.3                      | <1                     | 33                   | 15                      | 15000                     | 8.4                    | 160                  | 19                   | 10                | 84  |
| 1  |  | 1276     | 19960804    | 51 GL977636     | 6.7              | 6200                     | 3.0                     | 0.5                     | <1                       | 34                     | 17                   | 15000                   | 21.0                      | 160                    | 19                   | 6                    | 41                |     |
| 1  |  | 1276     | 19960804    | 51 GL977637     | 3.1              | 31000                    | 2.2                     | 0.2                     | <1                       | 38                     | 34                   | 38000                   | 3.9                       | 570                    | 42                   | 13                   | 98                |     |
| 1  |  | 1276     | 19960804    | 51 GL977638     | 3.1              | 30000                    | 4.0                     | 0.2                     | <1                       | 68                     | 28                   | 38000                   | 4.0                       | 530                    | 35                   | 12                   | 75                |     |
| 1  |  | 1276     | 19960804    | 51 GL977639     | 38.3             | 34000                    | 5.8                     | 0.2                     | <1                       | 68                     | 28                   | 45000                   | 3.0                       | 610                    | 48                   | 16                   | 100               |     |
| 1  |  | 1468     | 19960804    | 55 GL977651     | 36.3             | 11000                    | 4.4                     | 0.4                     | <1                       | 45                     | 32                   | 20000                   | 0.86                      | 460                    | 21                   | 14                   | 84                |     |
| ENE side of Hawkins Island<br>Healey Cove - Index Station  | 1  | 1468     | 19960804    | 55 GL977652     | 36.3             | 10000                    | 4.6                     | 0.5                     | <1                       | 45                     | 32                   | 20000                   | 0.86                      | 460                    | 21                   | 14                   | 84                |     |
|  | 1  | 1468     | 19960804    | 51 GL977653     | 40               | 10000                    | 4.6                     | 0.5                     | <1                       | 45                     | 32                   | 20000                   | 1.00                      | 470                    | 22                   | 18                   | 98                |     |
|  | 1  | 1468     | 19960804    | 55 GL977646     | 40.6             | 6900                     | 0.4                     | <1                      | <1                       | 39                     | 6                    | 18000                   | 0.07                      | 270                    | 16                   | 8                    | 41                |     |
|  | 1  | 1468     | 19960804    | 56 GL977649     | 31.2             | 6300                     | 0.6                     | <1                      | <1                       | 35                     | 6                    | 14000                   | 0.07                      | 250                    | 15                   | 2                    | 41                |     |
|  | 1  | 1408     | 19960804    | 51 GL977647     | 4.0              | 6000                     | 0.6                     | <1                      | <1                       | <1                     | 5                    | 12000                   | 0.04                      | 170                    | 13                   | 2                    | 41                |     |
|  | 1  | 1408     | 19960804    | 51 GL977647     | 4.0              | 6000                     | 0.6                     | <1                      | <1                       | <1                     | 5                    | 12000                   | 0.04                      | 170                    | 13                   | 2                    | 41                |     |
|  | 1  | 1408     | 19960804    | 51 GL977647     | 4.0              | 6000                     | 0.6                     | <1                      | <1                       | <1                     | 5                    | 12000                   | 0.04                      | 170                    | 13                   | 2                    | 41                |     |
|  | 1  | 1408     | 19960804    | 51 GL977647     | 4.0              | 6000                     | 0.6                     | <1                      | <1                       | <1                     | 5                    | 12000                   | 0.04                      | 170                    | 13                   | 2                    | 41                |     |
|  | 1  | 1408     | 19960804    | 51 GL977647     | 4.0              | 6000                     | 0.6                     | <1                      | <1                       | <1                     | 5                    | 12000                   | 0.04                      | 170                    | 13                   | 2                    | 41                |     |
|  | 1  | 1408     | 19960804    | 51 GL977647     | 4.0              | 6000                     | 0.6                     | <1                      | <1                       | <1                     | 5                    | 12000                   | 0.04                      | 170                    | 13                   | 2                    | 41                |     |
|  | 1  | 1408     | 19960804    | 51 GL977647     | 4.0              | 6000                     | 0.6                     | <1                      | <1                       | <1                     | 5                    | 12000                   | 0.04                      | 170                    | 13                   | 2                    | 41                |     |
|  | 1  | 1408     | 19960804    | 51 GL977647     | 4.0              | 6000                     | 0.6                     | <1                      | <1                       | <1                     | 5                    | 12000                   | 0.04                      | 170                    | 13                   | 2                    | 41                |     |
| Lowest Effect Level $\mu\text{g/g}$<br>Background - Great Lakes<br>pre-colonial sediment horizon, Persaud et al. (1992)<br>Background - Lake Superior pre-colonial sediment horizon-<br>geological bath, Muehich et al. (1988) (n=1) | 1  | 1269     | 19960804    | 51 GL977609     | 19               | 10000                    |                         | 0.8                     | <1                       | 31                     | 31                   | 20000                   | 0.52                      | 380                    | 20                   | 13                   | 73                |     |
|  | 1  | 1269     | 19960804    | 51 GL977627     | 19.3             | 11000                    |                         | 0.8                     | <1                       | 46                     | 31                   | 20000                   | 0.76                      | 400                    | 20                   | 10                   | 73                |     |
|  | 1  | 1269     | 19960804    | 51 GL977628     | 109.2            | 10000                    |                         | 0.7                     | <1                       | 40                     | 30                   | 19000                   | 0.84                      | 350                    | 20                   | 11                   | 73                |     |
|  | 1  | 1269     | 19960804    | 51 GL977629     | 19.3             | 11000                    |                         | 0.8                     | <1                       | 42                     | 33                   | 20000                   | 0.68                      | 350                    | 21                   | 13                   | 74                |     |
|  | 1  | 1269     | 19960804    | 51 GL977630     | 19.3             | 10000                    |                         | 0.6                     | <1                       | 41                     | 29                   | 20000                   | 0.65                      | 330                    | 21                   | 13                   | 72                |     |
|  | 1  | 1269     | 19960804    | 51 GL977634     | 8.7              | 6900                     | 2.9                     | 0.4                     | <1                       | 39                     | 21                   | 16000                   | 17.0                      | 180                    | 21                   | 13                   | 100               |     |
|  | 1  | 1276     | 19960804    | 51 GL977635     | 6.7              | 6400                     | 2.9                     | 0.3                     | <1                       | 33                     | 15                   | 15000                   | 8.4                       | 160                    | 19                   | 10                   | 84                |     |
|  | 1  | 1276     | 19960804    | 51 GL977636     | 6.7              | 6200                     | 3.0                     | 0.5                     | <1                       | 34                     | 17                   | 15000                   | 21.0                      | 160                    | 19                   | 6                    | 41                |     |
|  | 1  | 1276     | 19960804    | 51 GL977637     | 3.1              | 31000                    | 2.2                     | 0.2                     | <1                       | 38                     | 34                   | 38000                   | 3.9                       | 570                    | 42                   | 13                   | 98                |     |
|  | 1  | 1276     | 19960804    | 51 GL977638     | 3.1              | 30000                    | 4.0                     | 0.2                     | <1                       | 68                     | 28                   | 38000                   | 4.0                       | 530                    | 35                   | 12                   | 75                |     |
|  | 1  | 1276     | 19960804    | 51 GL977639     | 38.3             | 34000                    | 5.8                     | 0.2                     | <1                       | 68                     | 28                   | 45000                   | 3.0                       | 610                    | 48                   | 16                   | 100               |     |
|  | 1  | 1468     | 19960804    | 55 GL977651     | 36.3             | 11000                    | 4.4                     | 0.4                     | <1                       | 45                     | 32                   | 20000                   | 0.86                      | 460                    | 21                   | 14                   | 84                |     |
| 1  | 1468   | 19960804 | 51 GL977652 | 40              | 10000            | 4.6                      | 0.5                     | <1                      | 45                       | 32                     | 20000                | 1.00                    | 470                       | 22                     | 18                   | 98                   |                   |     |
| 1  | 1468   | 19960804 | 56 GL977646 | 40.6            | 6900             | 0.4                      | <1                      | <1                      | 39                       | 6                      | 18000                | 0.07                    | 270                       | 16                     | 8                    | 41                   |                   |     |
| 1  | 1468   | 19960804 | 56 GL977649 | 31.2            | 6300             | 0.6                      | <1                      | <1                      | 35                       | 6                      | 14000                | 0.07                    | 250                       | 15                     | 2                    | 41                   |                   |     |
| 1  | 1408   | 19960804 | 51 GL977647 | 4.0             | 6000             | 0.6                      | <1                      | <1                      | <1                       | 5                      | 12000                | 0.04                    | 170                       | 13                     | 2                    | 41                   |                   |     |
| 1  | 1408   | 19960804 | 51 GL977647 | 4.0             | 6000             | 0.6                      | <1                      | <1                      | <1                       | 5                      | 12000                | 0.04                    | 170                       | 13                     | 2                    | 41                   |                   |     |
| 1  | 1408   | 19960804 | 51 GL977647 | 4.0             | 6000             | 0.6                      | <1                      | <1                      | <1                       | 5                      | 12000                | 0.04                    | 170                       | 13                     | 2                    | 41                   |                   |     |
| 1  | 1408   | 19960804 | 51 GL977647 | 4.0             | 6000             | 0.6                      | <1                      | <1                      | <1                       | 5                      | 12000                | 0.04                    | 170                       | 13                     | 2                    | 41                   |                   |     |
| 1  | 1408   | 19960804 | 51 GL977647 | 4.0             | 6000             | 0.6                      | <1                      | <1                      | <1                       | 5                      | 12000                | 0.04                    | 170                       | 13                     | 2                    | 41                   |                   |     |
| 1  | 1408   | 19960804 | 51 GL977647 | 4.0             | 6000             | 0.6                      | <1                      | <1                      | <1                       | 5                      | 12000                | 0.04                    | 170                       | 13                     | 2                    | 41                   |                   |     |
| 1  | 1408   | 19960804 | 51 GL977647 | 4.0             | 6000             | 0.6                      | <1                      | <1                      | <1                       | 5                      | 12000                | 0.04                    | 170                       | 13                     | 2                    | 41                   |                   |     |
| 1  | 1408   | 19960804 | 51 GL977647 | 4.0             | 6000             | 0.6                      | <1                      | <1                      | <1                       | 5                      | 12000                | 0.04                    | 170                       | 13                     | 2                    | 41                   |                   |     |
| 1  | 1408   | 19960804 | 51 GL977647 | 4.0             | 6000             | 0.6                      | <1                      | <1                      | <1                       | 5                      | 12000                | 0.04                    | 170                       | 13                     | 2                    | 41                   |                   |     |
| 1  | 1408   | 19960804 | 51 GL977647 | 4.0             | 6000             | 0.6                      | <1                      | <1                      | <1                       | 5                      | 12000                | 0.04                    | 170                       | 13                     | 2                    | 41                   |                   |     |
| 1  | 1408   | 19960804 | 51 GL977647 | 4.0             | 6000             | 0.6                      | <1                      | <1                      | <1                       | 5                      | 12000                | 0.04                    | 170                       | 13                     | 2                    | 41                   |                   |     |
| 1  | 1408   | 19960804 | 51 GL977647 | 4.0             | 6000             | 0.6                      | <1                      | <1                      | <1                       | 5                      | 12000                | 0.04                    | 170                       | 13                     | 2                    | 41                   |                   |     |
| 1  | 1408   | 19960804 | 51 GL977647 | 4.0             | 6000             | 0.6                      | <1                      | <1                      | <1                       | 5                      |                      |                         |                           |                        |                      |                      |                   |     |

<W no measurable response

<T measurable trace amount, interpret with caution

1. *Microscopic examination of the specimen*







Table 4 : Concentrations of chlorinated organic compounds in sediment collected from Thunder Bay and Peninsula Harbour, 1999

| Station Description                         | Station Number | Date<br>YYYYMMDD | SMP<br>TYPE | Field<br>Sample No | Sample<br>Depth (m) | Hexa-<br>chlorobutadiene<br>ng/g (dry wt.) | 123 tri-<br>chlorobenzene<br>ng/g (dry wt.) | 1234 tetra-<br>chlorobenzene<br>ng/g (dry wt.) | 1235 penta-<br>chlorobenzene<br>ng/g (dry wt.) | 124 th<br>chlorobenzene<br>ng/g (dry wt.) |
|---|----------------|------------------|-------------|--------------------|---------------------|--|---|--|--|---|
| <b>Thunder Bay</b>                          |                |                  |             |                    |                     |  |   |  |  |   |
| Kam R. at Mission River<br>(split sample)   | 1              | 802              | 1990729     | 55                 | GL977604            | 8.2  | 1 <W  | 2 <W   | 1 <W   | 2 <W                                      |
|   | 1              | 802              | 1990729     | 55                 | GL977605            | 8.2  | 1 <W  | 2 <W   | 1 <W   | 2 <W                                      |
|   | 1              | 802              | 1990729     | 55                 | GL977606            | 8.2  | 1 <W  | 2 <W   | 1 <W   | 2 <W                                      |
| Kam River - mouth                           | 1              | 802              | 1990729     | 55                 | GL977607            | 8.1  | 1 <W  | 2 <W   | 1 <W   | 2 <W                                      |
|   | 1              | 463              | 1990729     | 55                 | GL977614            | 8.6  | 1 <W  | 2 <W   | 1 <W   | 2 <W                                      |
|   | 1              | 463              | 1990729     | 55                 | GL977615            | 8.9  | 1 <W  | 2 <W   | 1 <W   | 2 <W                                      |
| Mission River - mouth                       | 1              | 463              | 1990729     | 51                 | GL977616            | 9.2  | 1 <W  | 2 <W   | 1 <W   | 2 <W                                      |
|   | 1              | 176              | 1990729     | 51                 | GL977608            | 8.1  | 1 <W  | 2 <W   | 1 <W   | 2 <W                                      |
|   | 1              | 176              | 1990729     | 51                 | GL977609            | 8.1  | 1 <W  | 2 <W   | 1 <W   | 2 <W                                      |
| McKellar River - mouth                      | 1              | 176              | 1990729     | 51                 | GL977610            | 8.1  | 1 <W  | 2 <W   | 1 <W   | 2 <W                                      |
|   | 1              | 462              | 1990729     | 55                 | GL977611            | 4.3  | 1 <W  | 2 <W   | 1 <W   | 2 <W                                      |
|   | 1              | 462              | 1990729     | 55                 | GL977612            | 4.3  | 1 <W  | 2 <W   | 1 <W   | 2 <W                                      |
| North of Mission Bay Deposit                | 1              | 462              | 1990729     | 55                 | GL977613            | 4.3  | 1 <W  | 2 <W   | 1 <W   | 2 <W                                      |
|   | 1              | 464              | 1990729     | 55                 | GL977601            | 6.1  | 1 <W  | 2 <W   | 1 <W   | 2 <W                                      |
|   | 1              | 464              | 1990729     | 55                 | GL977602            | 6.2  | 1 <W  | 2 <W   | 1 <W   | 2 <W                                      |
| Old Abitibi outfall (north of Bare Pt.)     | 1              | 464              | 1990729     | 55                 | GL977603            | 6.2  | 1 <W  | 2 <W   | 1 <W   | 2 <W                                      |
|   | 1              | 466              | 1990729     | 55                 | GL977617            | 2.7  | 1 <W  | 2 <W   | 1 <W   | 2 <W                                      |
|   | 1              | 465              | 1990729     | 51                 | GL977618            | 2.4  | 1 <W  | 2 <W   | 1 <W   | 2 <W                                      |
| Provincial Paper (outside filtration bed)   | 1              | 465              | 1990729     | 51                 | GL977619            | 2.4  | 1 <W  | 2 <W   | 1 <W   | 2 <W                                      |
|   | 1              | 465              | 1990729     | 51                 | GL977620            | 2.4  | 1 <W  | 2 <W   | 1 <W   | 2 <W                                      |
|   | 1              | 284              | 1990730     | 51                 | GL977601            | 17.1                                       | 1 <W  | 2 <W   | 1 <W   | 2 <W                                      |
| Welcome Island - Index Station              | 1              | 284              | 1990730     | 51                 | GL977602            | 17.1                                       | 1 <W  | 2 <W   | 1 <W   | 2 <W                                      |
|   | 1              | 284              | 1990730     | 51                 | GL977603            | 17.2                                       | 1 <W  | 2 <W   | 1 <W   | 2 <W                                      |
| <b>Peninsula Harbour</b>                    |                |                  |             |                    |                     |  |   |  |  |   |
| Beatty Cove - Index Station                 | 1              | 289              | 1990804     | 51                 | GL977626            | 19   | 1 <W  | 2 <W   | 1 <W   | 2 <W                                      |
|   | 1              | 289              | 1990804     | 51                 | GL977627            | 19.3                                       | 1 <W  | 2 <W   | 1 <W   | 2 <W                                      |
|   | 1              | 289              | 1990804     | 51                 | GL977628            | 109.2                                      | 1 <W  | 2 <W   | 1 <W   | 2 <W                                      |
| Jellicoe Cove - Near wharf                  | 1              | 276              | 1990804     | 51                 | GL977654            | 6.7  | 1 <W  | 2 <W   | 1 <W   | 2 <W                                      |
|   | 1              | 276              | 1990804     | 51                 | GL977655            | 6.7  | 1 <W  | 2 <W   | 1 <W   | 2 <W                                      |
|   | 1              | 276              | 1990804     | 51                 | GL977656            | 6.7  | 1 <W  | 2 <W   | 1 <W   | 2 <W                                      |
| Jellicoe Cove - Near wharf                  | 1              | 279              | 1990804     | 55                 | GL977657            | 3.1  | 1 <W  | 2 <W   | 1 <W   | 2 <W                                      |
|   | 1              | 279              | 1990804     | 55                 | GL977658            | 3.1  | 1 <W  | 2 <W   | 1 <W   | 2 <W                                      |
|   | 1              | 279              | 1990804     | 55                 | GL977659            | 3.1  | 1 <W  | 2 <W   | 1 <W   | 2 <W                                      |
| NE side of Hawkins Island<br>(split sample) | 1              | 468              | 1990804     | 55                 | GL977660            | 39.3                                       | 1 <W  | 2 <W   | 1 <W   | 2 <W                                      |
|   | 1              | 468              | 1990804     | 55                 | GL977661            | 39.3                                       | 1 <W  | 2 <W   | 1 <W   | 2 <W                                      |
|   | 1              | 468              | 1990804     | 51                 | GL977662            | 40   | 1 <W  | 2 <W   | 1 <W   | 2 <W                                      |
| SW of Peninsula                             | 1              | 468              | 1990804     | 51                 | GL977663            | 39.4                                       | 1 <W  | 2 <W   | 1 <W   | 2 <W                                      |
|   | 1              | 469              | 1990804     | 55                 | GL977664            | 30.8                                       | 1 <W  | 2 <W   | 1 <W   | 2 <W                                      |
|   | 1              | 469              | 1990804     | 55                 | GL977649            | 41.2                                       | 1 <W  | 2 <W   | 1 <W   | 2 <W                                      |
| STP - 500 m S                               | 1              | 409              | 1990804     | 51                 | GL977647            | 4.9  | 1 <W  | 2 <W   | 1 <W   | 2 <W                                      |

<W no measurable response

<T measurable trace amount, interpret with caution



Table 4 : Concentrations of chlorinated organic compounds in sediment collected from Thunder Bay and Peninsula Harbour, 1999

| Station Description                       | Station Number | 1245-tetra chlorobenzene ng/g (dry wt.) | 135-tri chlorobenzene ng/g (dry wt.) | Hexa- chlorobenzene ng/g (dry wt.) | Hexa- chloroethane ng/g (dry wt.) | Octa- chlorostyrene ng/g (dry wt.) | Penta- chlorobenzene ng/g (dry wt.) | 2,3,6-tri chlorotoluene ng/g (dry wt.) | 2,4,5-tri chlorotoluene ng/g (dry wt.) | 2,6-dichloro- benzyl chloride ng/g (dry wt.) |
|---|----------------|---|--------------------------------------|------------------------------------|-----------------------------------|------------------------------------|-------------------------------------|--|--|--|
| <b>Thunder Bay</b>                        |                |   |                                      |                                    |                                   |                                    |                                     |  |  |  |
| Kam R at Mission River                    | 1              | 1                                       | 802                                  | 1 <=W                              | 1 <=W                             | 1 <=W                              | 1 <=W                               | 1 <=W                                  | 1 <=W                                  | 1 <=W  |
| (split sample)                            | 1              | 1                                       | 802                                  | 1 <=W                              | 2 <=W                             | 1 <=W                              | 1 <=W                               | 1 <=W                                  | 1 <=W                                  | 1 <=W  |
| (split sample)                            | 1              | 1                                       | 802                                  | 1 <=W                              | 2 <=W                             | 1 <=W                              | 1 <=W                               | 1 <=W                                  | 1 <=W                                  | 1 <=W  |
|   | 1              | 1                                       | 802                                  | 1 <=W                              | 2 <=W                             | 1 <=W                              | 1 <=W                               | 1 <=W                                  | 1 <=W                                  | 1 <=W  |
| Kam River - mouth                         | 1              | 1                                       | 463                                  | 1 <=W                              | 2 <=W                             | 1 <=W                              | 1 <=W                               | 1 <=W                                  | 1 <=W                                  | 1 <=W  |
|   | 1              | 1                                       | 463                                  | 1 <=W                              | 2 <=W                             | 1 <=W                              | 1 <=W                               | 1 <=W                                  | 1 <=W                                  | 1 <=W  |
|   | 1              | 1                                       | 463                                  | 1 <=W                              | 2 <=W                             | 1 <=W                              | 1 <=W                               | 1 <=W                                  | 1 <=W                                  | 1 <=W  |
| Mission River - mouth                     | 1              | 1                                       | 176                                  | 1 <=W                              | 2 <=W                             | 1 <=W                              | 1 <=W                               | 1 <=W                                  | 1 <=W                                  | 1 <=W  |
|   | 1              | 1                                       | 176                                  | 1 <=W                              | 2 <=W                             | 1 <=W                              | 1 <=W                               | 1 <=W                                  | 1 <=W                                  | 1 <=W  |
|   | 1              | 1                                       | 176                                  | 1 <=W                              | 2 <=W                             | 1 <=W                              | 1 <=W                               | 1 <=W                                  | 1 <=W                                  | 1 <=W  |
| McKellar River - mouth                    | 1              | 1                                       | 462                                  | 1 <=W                              | 2 <=W                             | 1 <=W                              | 1 <=W                               | 1 <=W                                  | 1 <=W                                  | 1 <=W  |
|   | 1              | 1                                       | 462                                  | 1 <=W                              | 2 <=W                             | 1 <=W                              | 1 <=W                               | 1 <=W                                  | 1 <=W                                  | 1 <=W  |
|   | 1              | 1                                       | 462                                  | 1 <=W                              | 2 <=W                             | 1 <=W                              | 1 <=W                               | 1 <=W                                  | 1 <=W                                  | 1 <=W  |
| North of Mission Bay Disposal             | 1              | 1                                       | 464                                  | 1 <=W                              | 2 <=W                             | 1 <=W                              | 1 <=W                               | 1 <=W                                  | 1 <=W                                  | 1 <=W  |
|   | 1              | 1                                       | 464                                  | 1 <=W                              | 2 <=W                             | 1 <=W                              | 1 <=W                               | 1 <=W                                  | 1 <=W                                  | 1 <=W  |
|   | 1              | 1                                       | 464                                  | 1 <=W                              | 2 <=W                             | 1 <=W                              | 1 <=W                               | 1 <=W                                  | 1 <=W                                  | 1 <=W  |
| Old Abitibi outfall (north of Bare Pt.)   | 1              | 1                                       | 466                                  | 1 <=W                              | 2 <=W                             | 1 <=W                              | 1 <=W                               | 1 <=W                                  | 1 <=W                                  | 1 <=W  |
| Provincial Paper (outside filtration bed) | 1              | 1                                       | 465                                  | 1 <=W                              | 2 <=W                             | 2 <=T                              | 1 <=W                               | 1 <=W                                  | 1 <=W                                  | 1 <=W  |
|   | 1              | 1                                       | 465                                  | 1 <=W                              | 2 <=W                             | 1 <=W                              | 1 <=W                               | 1 <=W                                  | 1 <=W                                  | 1 <=W  |
|   | 1              | 1                                       | 465                                  | 1 <=W                              | 2 <=W                             | 2 <=T                              | 1 <=W                               | 1 <=W                                  | 1 <=W                                  | 1 <=W  |
| Welcome Island - Index Station            | 1              | 1                                       | 284                                  | 1 <=W                              | 2 <=W                             | 1 <=W                              | 1 <=W                               | 1 <=W                                  | 1 <=W                                  | 1 <=W  |
|   | 1              | 1                                       | 284                                  | 1 <=W                              | 2 <=W                             | 1 <=W                              | 1 <=W                               | 1 <=W                                  | 1 <=W                                  | 1 <=W  |
|   | 1              | 1                                       | 284                                  | 1 <=W                              | 2 <=W                             | 1 <=W                              | 1 <=W                               | 1 <=W                                  | 1 <=W                                  | 1 <=W  |
| <b>Peninsula Harbour</b>                  |                |   |                                      |                                    |                                   |                                    |                                     |  |  |  |
| Beatty Cove - Index Station               | 1              | 1                                       | 289                                  | 1 <=W                              | 2 <=W                             | 5 <=T                              | 1 <=W                               | 1 <=W                                  | 1 <=W                                  | 1 <=W  |
|   | 1              | 1                                       | 289                                  | 1 <=W                              | 2 <=W                             | 6 <=T                              | 1 <=W                               | 1 <=W                                  | 1 <=W                                  | 1 <=W  |
|   | 1              | 1                                       | 289                                  | 1 <=W                              | 2 <=W                             | 6 <=T                              | 1 <=W                               | 1 <=W                                  | 1 <=W                                  | 1 <=W  |
| Jellicoe Cove - Near wharf                | 1              | 1                                       | 276                                  | 1 <=W                              | 28                                | 30                                 | 1 <=W                               | 1 <=W                                  | 1 <=W                                  | 1 <=W  |
|   | 1              | 1                                       | 276                                  | 1 <=W                              | 28                                | 60                                 | 1 <=W                               | 1 <=W                                  | 1 <=W                                  | 1 <=W  |
|   | 1              | 1                                       | 276                                  | 1 <=W                              | 28                                | 37                                 | 1 <=W                               | 1 <=W                                  | 1 <=W                                  | 1 <=W  |
| Jellicoe Cove - Near wharf                | 1              | 1                                       | 279                                  | 1 <=W                              | 4 <=T                             | 2 <=T                              | 1 <=W                               | 1 <=W                                  | 1 <=W                                  | 1 <=W  |
|   | 1              | 1                                       | 279                                  | 1 <=W                              | 4 <=T                             | 2 <=T                              | 1 <=W                               | 1 <=W                                  | 1 <=W                                  | 1 <=W  |
|   | 1              | 1                                       | 279                                  | 1 <=W                              | 4 <=T                             | 1 <=W                              | 1 <=W                               | 1 <=W                                  | 1 <=W                                  | 1 <=W  |
| NE side of Hawkins Island                 | 1              | 1                                       | 468                                  | 1 <=W                              | 2 <=W                             | 8 <=T                              | 1 <=W                               | 1 <=W                                  | 1 <=W                                  | 1 <=W  |
| (split sample)                            | 1              | 1                                       | 468                                  | 1 <=W                              | 2 <=W                             | 6 <=T                              | 1 <=W                               | 1 <=W                                  | 1 <=W                                  | 1 <=W  |
|   | 1              | 1                                       | 468                                  | 1 <=W                              | 2 <=W                             | 10                                 | 1 <=W                               | 1 <=W                                  | 1 <=W                                  | 1 <=W  |
| SW of Peninsula                           | 1              | 1                                       | 468                                  | 1 <=W                              | 2 <=W                             | 9 <=T                              | 1 <=W                               | 1 <=W                                  | 1 <=W                                  | 1 <=W  |
|   | 1              | 1                                       | 469                                  | 1 <=W                              | 2 <=W                             | 1 <=W                              | 1 <=W                               | 1 <=W                                  | 1 <=W                                  | 1 <=W  |
|   | 1              | 1                                       | 469                                  | 1 <=W                              | 2 <=W                             | 1 <=W                              | 1 <=W                               | 1 <=W                                  | 1 <=W                                  | 1 <=W  |
| STP - 500 m S                             | 1              | 1                                       | 409                                  | 1 <=W                              | 2 <=W                             | 1 <=W                              | 1 <=W                               | 1 <=W                                  | 1 <=W                                  | 1 <=W  |

<W no measurable response

<T measurable trace amount, interpret with caution



Table 5: Concentrations of organochlorine pesticides and total PCBs in sediment collected from Lake Superior and the Spanish River, 1999

| Station Number | Station Description                     | Date<br>YYMMDD | SUP<br>TYPE | Field<br>Sample No. | Sample<br>Depth (m) | Σα-HCH<br>ng/g | β-HCH<br>ng/g | γ-HCH<br>ng/g | δ-HCH<br>ng/g | Σγ-Chlordane<br>ng/g | Σδ-Chlordane<br>ng/g | Dechlor<br>ng/g | Methoxychlor<br>ng/g | RMK  |
|----------------|---|----------------|-------------|---------------------|---------------------|----------------|---------------|---------------|---------------|----------------------|----------------------|-----------------|----------------------|------|
| 14-1-400       | Spanish River                           | 19990810       | 55          | GL977680            | 2.2                 | 1<EW           | 1<EW          | 1<EW          | 1<EW          | 2<EW                 | 2<EW                 | 2<EW            | 2<EW                 | 5<EW |
| 14-1-401       | Mouth of Spanish River                  | 19990810       | 51          | GL977681            | 2.1                 | 1<EW           | 1<EW          | 1<EW          | 1<EW          | 2<EW                 | 2<EW                 | 2<EW            | 2<EW                 | 5<EW |
| 14-1-402       |   | 19990810       | 51          | GL977682            | 0.2                 | 1<EW           | 1<EW          | 1<EW          | 1<EW          | 2<EW                 | 2<EW                 | 2<EW            | 2<EW                 | 5<EW |
| 14-1-381       | Index Station                           | 19990811       | 51          | GL977683            | 8                   | 1<EW           | 1<EW          | 1<EW          | 1<EW          | 2<EW                 | 2<EW                 | 2<EW            | 2<EW                 | 5<EW |
| 14-1-382       |   | 19990811       | 51          | GL977684            | 9                   | 1<EW           | 1<EW          | 1<EW          | 1<EW          | 2<EW                 | 2<EW                 | 2<EW            | 2<EW                 | 5<EW |
| 14-1-383       |   | 19990811       | 51          | GL977685            | 9.8                 | 1<EW           | 1<EW          | 1<EW          | 1<EW          | 2<EW                 | 2<EW                 | 2<EW            | 2<EW                 | 5<EW |
| 14-1-384       |   | 19990811       | 51          | GL977686            | 9.9                 | 1<EW           | 1<EW          | 1<EW          | 1<EW          | 2<EW                 | 2<EW                 | 2<EW            | 2<EW                 | 5<EW |
| 14-1-385       |   | 19990811       | 54          | GL953010            | 7.3                 | 1<EW           | 1<EW          | 1<EW          | 1<EW          | 2<EW                 | 2<EW                 | 2<EW            | 2<EW                 | 5<EW |
| 14-1-386       | Whaleback Channel                       | 19991019       | 51          | GL977687            | 22.7                | 1<EW           | 1<EW          | 1<EW          | 1<EW          | 2<EW                 | 2<EW                 | 2<EW            | 2<EW                 | 5<EW |
| 14-1-401       |   | 19990810       | 51          | GL977670            | 22.7                | 1<EW           | 1<EW          | 1<EW          | 1<EW          | 2<EW                 | 2<EW                 | 2<EW            | 2<EW                 | 5<EW |
| 14-1-402       |   | 19990810       | 51          | GL977671            | 22.7                | 1<EW           | 1<EW          | 1<EW          | 1<EW          | 2<EW                 | 2<EW                 | 2<EW            | 2<EW                 | 5<EW |
| 14-1-403       | Whaleback Channel (near Gateway Island) | 19990810       | 51          | GL977672            | 22.7                | 1<EW           | 1<EW          | 1<EW          | 1<EW          | 2<EW                 | 2<EW                 | 2<EW            | 2<EW                 | 5<EW |
| 14-1-259       |   | 19990810       | 51          | GL977687            | 14.9                | 1<EW           | 1<EW          | 1<EW          | 1<EW          | 2<EW                 | 2<EW                 | 2<EW            | 2<EW                 | 5<EW |
| 14-1-258       |   | 19990810       | 51          | GL977688            | 15.6                | 1<EW           | 1<EW          | 1<EW          | 1<EW          | 2<EW                 | 2<EW                 | 2<EW            | 2<EW                 | 5<EW |
| 14-1-259       |   | 19990810       | 51          | GL977689            | 15.6                | 1<EW           | 1<EW          | 1<EW          | 1<EW          | 2<EW                 | 2<EW                 | 2<EW            | 2<EW                 | 5<EW |
| 14-1-402       | Alford Bay                              | 19990810       | 51          | GL977673            | 8.1                 | 1<EW           | 1<EW          | 1<EW          | 1<EW          | 2<EW                 | 2<EW                 | 2<EW            | 2<EW                 | 5<EW |
| 14-1-403       |   | 19990810       | 51          | GL977674            | 8.1                 | 1<EW           | 1<EW          | 1<EW          | 1<EW          | 2<EW                 | 2<EW                 | 2<EW            | 2<EW                 | 5<EW |
| 14-1-404       |   | 19990810       | 55          | GL977675            | 8.1                 | 1<EW           | 1<EW          | 1<EW          | 1<EW          | 2<EW                 | 2<EW                 | 2<EW            | 2<EW                 | 5<EW |
| 14-1-405       |   | 19990810       | 55          | GL977676            | 8.1                 | 1<EW           | 1<EW          | 1<EW          | 1<EW          | 2<EW                 | 2<EW                 | 2<EW            | 2<EW                 | 5<EW |
| 14-1-406       | Near Shanty Island                      | 19990810       | 51          | GL977677            | 11.6                | 1<EW           | 1<EW          | 1<EW          | 1<EW          | 2<EW                 | 2<EW                 | 2<EW            | 2<EW                 | 5<EW |
| 14-1-407       |   | 19990810       | 51          | GL977678            | 11.6                | 1<EW           | 1<EW          | 1<EW          | 1<EW          | 2<EW                 | 2<EW                 | 2<EW            | 2<EW                 | 5<EW |
| 14-1-408       |   | 19990810       | 51          | GL977679            | 2.2                 | 1<EW           | 1<EW          | 1<EW          | 1<EW          | 2<EW                 | 2<EW                 | 2<EW            | 2<EW                 | 5<EW |
| 14-1-409       | Near Little Detroit                     | 19990810       | 51          | GL977683            | 33.7                | 1<EW           | 1<EW          | 1<EW          | 1<EW          | 2<EW                 | 2<EW                 | 2<EW            | 2<EW                 | 5<EW |
| 14-1-404       |   | 19990810       | 51          | GL977684            | 33.3                | 1<EW           | 1<EW          | 1<EW          | 1<EW          | 2<EW                 | 2<EW                 | 2<EW            | 2<EW                 | 5<EW |
| 14-1-404       |   | 19990810       | 51          | GL977685            | 33.2                | 1<EW           | 1<EW          | 1<EW          | 1<EW          | 2<EW                 | 2<EW                 | 2<EW            | 2<EW                 | 5<EW |
| 14-1-405       | Nipigon Bay                             | 19990731       | 51          | GL977631            | 28.7                | 1<EW           | 1<EW          | 1<EW          | 1<EW          | 2<EW                 | 2<EW                 | 2<EW            | 2<EW                 | 5<EW |
| 14-1-406       | Continuation of Nipigon R               | 19990731       | 51          | GL977632            | 28.6                | 1<EW           | 1<EW          | 1<EW          | 1<EW          | 2<EW                 | 2<EW                 | 2<EW            | 2<EW                 | 5<EW |
| 14-1-407       |   | 19990731       | 51          | GL977633            | 28.6                | 1<EW           | 1<EW          | 1<EW          | 1<EW          | 2<EW                 | 2<EW                 | 2<EW            | 2<EW                 | 5<EW |
| 14-1-408       | Nipigon Bay, 30 m S of mill outfall     | 19990731       | 51          | GL977628            | 2.8                 | 1<EW           | 1<EW          | 1<EW          | 1<EW          | 2<EW                 | 2<EW                 | 2<EW            | 2<EW                 | 5<EW |
| 14-1-409       |   | 19990731       | 51          | GL977629            | 3.0                 | 1<EW           | 1<EW          | 1<EW          | 1<EW          | 2<EW                 | 2<EW                 | 2<EW            | 2<EW                 | 5<EW |
| 14-1-410       |   | 19990731       | 55          | GL977630            | 3.0                 | 1<EW           | 1<EW          | 1<EW          | 1<EW          | 2<EW                 | 2<EW                 | 2<EW            | 2<EW                 | 5<EW |
| 14-1-411       | Nipigon Bay, NW of Five Mile Pt.        | 19990731       | 51          | GL977624            | 21.6                | 1<EW           | 1<EW          | 1<EW          | 1<EW          | 2<EW                 | 2<EW                 | 2<EW            | 2<EW                 | 5<EW |
| 14-1-412       |   | 19990731       | 51          | GL977625            | 21.6                | 1<EW           | 1<EW          | 1<EW          | 1<EW          | 2<EW                 | 2<EW                 | 2<EW            | 2<EW                 | 5<EW |
| 14-1-413       |   | 19990731       | 55          | GL977626            | 21.6                | 1<EW           | 1<EW          | 1<EW          | 1<EW          | 2<EW                 | 2<EW                 | 2<EW            | 2<EW                 | 5<EW |
| 14-1-414       |   | 19990731       | 55          | GL977627            | 21.6                | 1<EW           | 1<EW          | 1<EW          | 1<EW          | 2<EW                 | 2<EW                 | 2<EW            | 2<EW                 | 5<EW |
| 14-1-415       | Nipigon Bay, Index Station              | 19990731       | 51          | GL977631            | 14.0                | 1<EW           | 1<EW          | 1<EW          | 1<EW          | 2<EW                 | 2<EW                 | 2<EW            | 2<EW                 | 5<EW |
| 14-1-286       |   | 19990731       | 51          | GL977632            | 14.0                | 1<EW           | 1<EW          | 1<EW          | 1<EW          | 2<EW                 | 2<EW                 | 2<EW            | 2<EW                 | 5<EW |
| 14-1-287       |   | 19990731       | 51          | GL977633            | 14.0                | 1<EW           | 1<EW          | 1<EW          | 1<EW          | 2<EW                 | 2<EW                 | 2<EW            | 2<EW                 | 5<EW |
| 14-1-288       |   | 19991011       | 54          | GL953003            | 12.2                | 1<EW           | 1<EW          | 1<EW          | 1<EW          | 2<EW                 | 2<EW                 | 2<EW            | 2<EW                 | 5<EW |
| 14-1-289       | Nipigon Bay, West of Frog Island        | 19991011       | 51          | GL977628            | 30.0                | 1<EW           | 1<EW          | 1<EW          | 1<EW          | 2<EW                 | 2<EW                 | 2<EW            | 2<EW                 | 5<EW |
| 14-1-290       |   | 19991011       | 51          | GL977629            | 30.0                | 1<EW           | 1<EW          | 1<EW          | 1<EW          | 2<EW                 | 2<EW                 | 2<EW            | 2<EW                 | 5<EW |
| 14-1-291       |   | 19991011       | 51          | GL977630            | 30.0                | 1<EW           | 1<EW          | 1<EW          | 1<EW          | 2<EW                 | 2<EW                 | 2<EW            | 2<EW                 | 5<EW |
| 14-1-292       |   | 19991011       | 51          | GL977631            | 30.0                | 1<EW           | 1<EW          | 1<EW          | 1<EW          | 2<EW                 | 2<EW                 | 2<EW            | 2<EW                 | 5<EW |
| 14-1-293       |   | 19991011       | 51          | GL977632            | 30.0                | 1<EW           | 1<EW          | 1<EW          | 1<EW          | 2<EW                 | 2<EW                 | 2<EW            | 2<EW                 | 5<EW |
| 14-1-294       |   | 19991011       | 51          | GL977633            | 29.6                | 1<EW           | 1<EW          | 1<EW          | 1<EW          | 2<EW                 | 2<EW                 | 2<EW            | 2<EW                 | 5<EW |







Table 5: Concentrations of organochlorine pesticides and total PCBs in sediment collected from Lake Superior and the Spanish River, 1999

| Station Description                    | Station Number | Endosulfan I<br>ng/g | Endosulfan II<br>ng/g | Endosulfan sulfate<br>ng/g | Heptachlor Epoxide<br>ng/g | Heptachlor<br>ng/g | Mirex<br>ng/g | Cyfluthrin<br>ng/g | Permethrin<br>ng/g | DDT<br>ng/g | PCDD<br>ng/g | PCDF<br>ng/g | PCB<br>ng/g | Chlordane<br>ng/g |
|--|----------------|----------------------|-----------------------|----------------------------|----------------------------|--------------------|---------------|--------------------|--------------------|-------------|--------------|--------------|-------------|-------------------|
| <b>Spanish River</b>                   |                |                      |                       |                            |                            |                    |               |                    |                    |             |              |              |             |                   |
| South of Spanish River                 | 14-11-205      | 2 <EW                | 4 <EW                 | 4 <EW                      | 4 <EW                      | 1 <EW              | 1 <EW         | 5 <EW              | 2 <EW              | 2 <EW       | 5 <EW        | 1 <EW        | 1 <EW       | 5 <EW             |
| Indian River                           | 14-11-201      | 2 <EW                | 4 <EW                 | 4 <EW                      | 4 <EW                      | 1 <EW              | 1 <EW         | 5 <EW              | 2 <EW              | 2 <EW       | 5 <EW        | 1 <EW        | 1 <EW       | 5 <EW             |
| Index Station                          | 14-11-381      | 2 <EW                | 4 <EW                 | 4 <EW                      | 4 <EW                      | 1 <EW              | 1 <EW         | 5 <EW              | 2 <EW              | 2 <EW       | 5 <EW        | 1 <EW        | 1 <EW       | 5 <EW             |
| Waukegan Channel                       | 14-11-381      | 2 <EW                | 4 <EW                 | 4 <EW                      | 4 <EW                      | 1 <EW              | 1 <EW         | 5 <EW              | 2 <EW              | 2 <EW       | 5 <EW        | 1 <EW        | 1 <EW       | 5 <EW             |
|  | 14-11-401      | 2 <EW                | 4 <EW                 | 4 <EW                      | 4 <EW                      | 1 <EW              | 1 <EW         | 5 <EW              | 2 <EW              | 2 <EW       | 5 <EW        | 1 <EW        | 1 <EW       | 5 <EW             |
|  | 14-11-401      | 2 <EW                | 4 <EW                 | 4 <EW                      | 4 <EW                      | 1 <EW              | 1 <EW         | 5 <EW              | 2 <EW              | 2 <EW       | 5 <EW        | 1 <EW        | 1 <EW       | 5 <EW             |
|  | 14-11-299      | 2 <EW                | 4 <EW                 | 4 <EW                      | 4 <EW                      | 1 <EW              | 1 <EW         | 5 <EW              | 2 <EW              | 2 <EW       | 5 <EW        | 1 <EW        | 1 <EW       | 5 <EW             |
| Waukegan Channel (near Germany Island) | 14-11-299      | 2 <EW                | 4 <EW                 | 4 <EW                      | 4 <EW                      | 1 <EW              | 1 <EW         | 5 <EW              | 2 <EW              | 2 <EW       | 5 <EW        | 1 <EW        | 1 <EW       | 5 <EW             |
| Argo Bay                               | 14-11-402      | 2 <EW                | 4 <EW                 | 4 <EW                      | 4 <EW                      | 1 <EW              | 1 <EW         | 5 <EW              | 2 <EW              | 2 <EW       | 5 <EW        | 1 <EW        | 1 <EW       | 5 <EW             |
|  | 14-11-402      | 2 <EW                | 4 <EW                 | 4 <EW                      | 4 <EW                      | 1 <EW              | 1 <EW         | 5 <EW              | 2 <EW              | 2 <EW       | 5 <EW        | 1 <EW        | 1 <EW       | 5 <EW             |
|  | 14-11-402      | 2 <EW                | 4 <EW                 | 4 <EW                      | 4 <EW                      | 1 <EW              | 1 <EW         | 5 <EW              | 2 <EW              | 2 <EW       | 5 <EW        | 1 <EW        | 1 <EW       | 5 <EW             |
| near Shark Island                      | 14-11-403      | 2 <EW                | 4 <EW                 | 4 <EW                      | 4 <EW                      | 1 <EW              | 1 <EW         | 5 <EW              | 2 <EW              | 2 <EW       | 5 <EW        | 1 <EW        | 1 <EW       | 5 <EW             |
|  | 14-11-403      | 2 <EW                | 4 <EW                 | 4 <EW                      | 4 <EW                      | 1 <EW              | 1 <EW         | 5 <EW              | 2 <EW              | 2 <EW       | 5 <EW        | 1 <EW        | 1 <EW       | 5 <EW             |
| Near Lime Ditch                        | 14-11-404      | 2 <EW                | 4 <EW                 | 4 <EW                      | 4 <EW                      | 1 <EW              | 1 <EW         | 5 <EW              | 2 <EW              | 2 <EW       | 5 <EW        | 1 <EW        | 1 <EW       | 5 <EW             |
|  | 14-11-404      | 2 <EW                | 4 <EW                 | 4 <EW                      | 4 <EW                      | 1 <EW              | 1 <EW         | 5 <EW              | 2 <EW              | 2 <EW       | 5 <EW        | 1 <EW        | 1 <EW       | 5 <EW             |
|  | 14-11-404      | 2 <EW                | 4 <EW                 | 4 <EW                      | 4 <EW                      | 1 <EW              | 1 <EW         | 5 <EW              | 2 <EW              | 2 <EW       | 5 <EW        | 1 <EW        | 1 <EW       | 5 <EW             |
| <b>Nipigon Bay</b>                     |                |                      |                       |                            |                            |                    |               |                    |                    |             |              |              |             |                   |
| Southwest of Nipigon R                 | 11-11-456      | 2 <EW                | 4 <EW                 | 4 <EW                      | 4 <EW                      | 1 <EW              | 1 <EW         | 5 <EW              | 2 <EW              | 2 <EW       | 5 <EW        | 1 <EW        | 1 <EW       | 5 <EW             |
|  | 11-11-456      | 2 <EW                | 4 <EW                 | 4 <EW                      | 4 <EW                      | 1 <EW              | 1 <EW         | 5 <EW              | 2 <EW              | 2 <EW       | 5 <EW        | 1 <EW        | 1 <EW       | 5 <EW             |
| Nipigon Bay, 30 m S. of mid outlet     | 11-11-456      | 2 <EW                | 4 <EW                 | 4 <EW                      | 4 <EW                      | 1 <EW              | 1 <EW         | 5 <EW              | 2 <EW              | 2 <EW       | 5 <EW        | 1 <EW        | 1 <EW       | 5 <EW             |
|  | 11-11-459      | 2 <EW                | 4 <EW                 | 4 <EW                      | 4 <EW                      | 1 <EW              | 1 <EW         | 5 <EW              | 2 <EW              | 2 <EW       | 5 <EW        | 1 <EW        | 1 <EW       | 5 <EW             |
| Nipigon Bay - NW of Five Mile Pt       | 11-11-461      | 2 <EW                | 4 <EW                 | 4 <EW                      | 4 <EW                      | 1 <EW              | 1 <EW         | 5 <EW              | 2 <EW              | 2 <EW       | 5 <EW        | 1 <EW        | 1 <EW       | 5 <EW             |
|  | 11-11-461      | 2 <EW                | 4 <EW                 | 4 <EW                      | 4 <EW                      | 1 <EW              | 1 <EW         | 5 <EW              | 2 <EW              | 2 <EW       | 5 <EW        | 1 <EW        | 1 <EW       | 5 <EW             |
| Nipigon Bay - Index Station            | 11-11-461      | 2 <EW                | 4 <EW                 | 4 <EW                      | 4 <EW                      | 1 <EW              | 1 <EW         | 5 <EW              | 2 <EW              | 2 <EW       | 5 <EW        | 1 <EW        | 1 <EW       | 5 <EW             |
|  | 11-11-286      | 2 <EW                | 4 <EW                 | 4 <EW                      | 4 <EW                      | 1 <EW              | 1 <EW         | 5 <EW              | 2 <EW              | 2 <EW       | 5 <EW        | 1 <EW        | 1 <EW       | 5 <EW             |
|  | 11-11-286      | 2 <EW                | 4 <EW                 | 4 <EW                      | 4 <EW                      | 1 <EW              | 1 <EW         | 5 <EW              | 2 <EW              | 2 <EW       | 5 <EW        | 1 <EW        | 1 <EW       | 5 <EW             |
| Nipigon Bay - West of Frog Island      | 11-11-869      | 2 <EW                | 4 <EW                 | 4 <EW                      | 4 <EW                      | 1 <EW              | 1 <EW         | 5 <EW              | 2 <EW              | 2 <EW       | 5 <EW        | 1 <EW        | 1 <EW       | 5 <EW             |
|  | 11-11-869      | 2 <EW                | 4 <EW                 | 4 <EW                      | 4 <EW                      | 1 <EW              | 1 <EW         | 5 <EW              | 2 <EW              | 2 <EW       | 5 <EW        | 1 <EW        | 1 <EW       | 5 <EW             |







Table 5: Concentrations of organochlorine pesticides and total PCBs in sediment collected from Lake Superior and the Spanish River, 1999

| Station Description                                 | Station Number | Date<br>YYYYMMDD | SMP<br>TYPE | Field<br>Sample No | Sample<br>Depth (m) | Aldrin<br>ng/g | $\alpha$ -BHC<br>ng/g | $\beta$ -BHC<br>ng/g | $\gamma$ -BHC<br>ng/g | $\alpha$ -Chlordane<br>ng/g | $\gamma$ -Chlordane<br>ng/g | Dieldrin<br>ng/g | Methoxychlor<br>ng/g | Endosulphan I<br>ng/g | Endosulphan II<br>ng/g |
|---|----------------|------------------|-------------|--------------------|---------------------|----------------|-----------------------|----------------------|-----------------------|-----------------------------|-----------------------------|------------------|----------------------|-----------------------|------------------------|
| <b>Thunder Bay</b>                                  |                |                  |             |                    |                     |                |                       |                      |                       |                             |                             |                  |                      |                       |                        |
| Kam R. at Mission River<br>(split sample)           | 1              | 802              | 19990729    | 55 GL977604        | 8.2                 | 1 <=W          | 1 <=W                 | 1 <=W                | 1 <=W                 | 2 <=W                       | 2 <=W                       | 2 <=W            | 5 <=W                | 2 <=W                 | 4 <=W                  |
|   | 1              | 802              | 19990729    | 55 GL977605        | 8.2                 | 1 <=W          | 1 <=W                 | 1 <=W                | 1 <=W                 | 2 <=W                       | 2 <=W                       | 2 <=W            | 5 <=W                | 2 <=W                 | 4 <=W                  |
|   | 1              | 802              | 19990729    | 55 GL977606        | 8.2                 | 1 <=W          | 1 <=W                 | 1 <=W                | 1 <=W                 | 2 <=W                       | 2 <=W                       | 2 <=W            | 5 <=W                | 2 <=W                 | 4 <=W                  |
|   | 1              | 802              | 19990729    | 55 GL977607        | 8.2                 | 1 <=W          | 1 <=W                 | 1 <=W                | 1 <=W                 | 2 <=W                       | 2 <=W                       | 2 <=W            | 5 <=W                | 2 <=W                 | 4 <=W                  |
| Kam River - mouth                                   | 1              | 1463             | 19990729    | 55 GL977614        | 8.8                 | 1 <=W          | 1 <=W                 | 1 <=W                | 1 <=W                 | 2 <=W                       | 2 <=W                       | 2 <=W            | 5 <=W                | 2 <=W                 | 4 <=W                  |
|   | 1              | 1463             | 19990729    | 55 GL977615        | 8.9                 | 1 <=W          | 1 <=W                 | 1 <=W                | 2 <=W                 | 2 <=W                       | 2 <=W                       | 2 <=W            | 5 <=W                | 2 <=W                 | 4 <=W                  |
|   | 1              | 1463             | 19990729    | 51 GL977616        | 9.2                 | 1 <=W          | 1 <=W                 | 1 <=W                | 1 <=W                 | 2 <=W                       | 2 <=W                       | 2 <=W            | 5 <=W                | 2 <=W                 | 4 <=W                  |
| Mission River - mouth                               | 1              | 176              | 19990729    | 51 GL977608        | 8.1                 | 1 <=W          | 1 <=W                 | 1 <=W                | 1 <=W                 | 2 <=W                       | 2 <=W                       | 2 <=W            | 5 <=W                | 2 <=W                 | 4 <=W                  |
|   | 1              | 176              | 19990729    | 51 GL977609        | 8.1                 | 1 <=W          | 1 <=W                 | 1 <=W                | 1 <=W                 | 2 <=W                       | 2 <=W                       | 2 <=W            | 5 <=W                | 2 <=W                 | 4 <=W                  |
|   | 1              | 176              | 19990729    | 51 GL977610        | 8.1                 | 1 <=W          | 1 <=W                 | 1 <=W                | 1 <=W                 | 2 <=W                       | 2 <=W                       | 2 <=W            | 5 <=W                | 2 <=W                 | 4 <=W                  |
| McKellar River - mouth                              | 1              | 1462             | 19990729    | 55 GL977611        | 4.3                 | 1 <=W          | 1 <=W                 | 1 <=W                | 1 <=W                 | 2 <=W                       | 2 <=W                       | 2 <=W            | 5 <=W                | 2 <=W                 | 4 <=W                  |
|   | 1              | 1462             | 19990729    | 55 GL977612        | 4.3                 | 1 <=W          | 1 <=W                 | 1 <=W                | 1 <=W                 | 2 <=W                       | 2 <=W                       | 2 <=W            | 5 <=W                | 2 <=W                 | 4 <=W                  |
|   | 1              | 1462             | 19990729    | 55 GL977613        | 4.3                 | 1 <=W          | 1 <=W                 | 1 <=W                | 1 <=W                 | 2 <=W                       | 2 <=W                       | 2 <=W            | 5 <=W                | 2 <=W                 | 4 <=W                  |
| North of Mission Bay Disposal                       | 1              | 1464             | 19990729    | 55 GL977601        | 6.1                 | 1 <=W          | 1 <=W                 | 1 <=W                | 1 <=W                 | 2 <=W                       | 2 <=W                       | 2 <=W            | 5 <=W                | 2 <=W                 | 4 <=W                  |
|   | 1              | 1464             | 19990729    | 55 GL977602        | 6.2                 | 1 <=W          | 1 <=W                 | 1 <=W                | 1 <=W                 | 2 <=W                       | 2 <=W                       | 2 <=W            | 5 <=W                | 2 <=W                 | 4 <=W                  |
|   | 1              | 1464             | 19990729    | 55 GL977603        | 6.2                 | 1 <=W          | 1 <=W                 | 1 <=W                | 1 <=W                 | 2 <=W                       | 2 <=W                       | 2 <=W            | 5 <=W                | 2 <=W                 | 4 <=W                  |
| old Abbe outfall (north of Bare Pt.)                | 1              | 1466             | 19990729    | 55 GL977617        | 2.7                 | 1 <=W          | 1 <=W                 | 1 <=W                | 1 <=W                 | 2 <=W                       | 2 <=W                       | 2 <=W            | 5 <=W                | 2 <=W                 | 4 <=W                  |
| Provincial Paper (outside fibron bed)               | 1              | 1465             | 19990729    | 51 GL977618        | 2.4                 | 1 <=W          | 1 <=W                 | 3 <=T                | 1 <=W                 | 2 <=W                       | 2 <=W                       | 2 <=W            | 5 <=W                | 2 <=W                 | 4 <=W                  |
|   | 1              | 1465             | 19990729    | 51 GL977619        | 2.4                 | 1 <=W          | 1 <=W                 | 3 <=T                | 1 <=W                 | 2 <=W                       | 2 <=W                       | 2 <=W            | 5 <=W                | 2 <=W                 | 4 <=W                  |
|   | 1              | 1465             | 19990729    | 51 GL977620        | 2.4                 | 1 <=W          | 1 <=W                 | 3 <=T                | 1 <=W                 | 2 <=W                       | 2 <=W                       | 2 <=W            | 5 <=W                | 2 <=W                 | 4 <=W                  |
| Welcome Island - Index Station                      | 1              | 1284             | 19990730    | 51 GL977601        | 17.1                | 1 <=W          | 1 <=W                 | 1 <=W                | 1 <=W                 | 2 <=W                       | 2 <=W                       | 2 <=W            | 5 <=W                | 2 <=W                 | 4 <=W                  |
|   | 1              | 1284             | 19990730    | 51 GL977602        | 17.1                | 1 <=W          | 1 <=W                 | 3 <=T                | 1 <=W                 | 2 <=W                       | 2 <=W                       | 2 <=W            | 5 <=W                | 2 <=W                 | 4 <=W                  |
|   | 1              | 1284             | 19990730    | 51 GL977603        | 17.2                | 1 <=W          | 1 <=W                 | 5 <=T                | 1 <=W                 | 2 <=W                       | 2 <=W                       | 2 <=W            | 5 <=W                | 2 <=W                 | 4 <=W                  |
| <b>Peninsular Harbour</b>                           |                |                  |             |                    |                     |                |                       |                      |                       |                             |                             |                  |                      |                       |                        |
| Beatty Cove - Index Station                         | 1              | 289              | 19990804    | 51 GL977626        | 19                  | 1 <=W          | 2 <=T                 | 1 <=W                | 1 <=W                 | 2 <=W                       | 2 <=W                       | 2 <=W            | 5 <=W                | 2 <=W                 | 4 <=W                  |
|   | 1              | 289              | 19990804    | 51 GL977627        | 19.3                | 1 <=W          | 2 <=T                 | 1 <=W                | 1 <=W                 | 2 <=W                       | 2 <=W                       | 2 <=W            | 5 <=W                | 2 <=W                 | 4 <=W                  |
|   | 1              | 289              | 19990804    | 51 GL977628        | 109.2               | 1 <=W          | 3 <=T                 | 1 <=W                | 1 <=W                 | 2 <=W                       | 2 <=W                       | 2 <=W            | 5 <=W                | 2 <=W                 | 4 <=W                  |
| Jelliscoe Cove - Near wharf                         | 1              | 276              | 19990804    | 51 GL977654        | 6.7                 | 1 <=W          | 1 <=W                 | 1 <=W                | 2 <=T                 | 2 <=W                       | 2 <=W                       | 2 <=W            | 5 <=W                | 2 <=W                 | 4 <=W                  |
|   | 1              | 276              | 19990804    | 51 GL977655        | 6.7                 | 1 <=W          | 1 <=W                 | 1 <=W                | 1 <=W                 | 2 <=W                       | 2 <=W                       | 2 <=W            | 5 <=W                | 2 <=W                 | 4 <=W                  |
|   | 1              | 276              | 19990804    | 51 GL977656        | 6.7                 | 1 <=W          | 1 <=W                 | 1 <=W                | 1 <=W                 | 2 <=W                       | 2 <=W                       | 2 <=W            | 5 <=W                | 2 <=W                 | 4 <=W                  |
| Jelliscoe Cove - Near wharf                         | 1              | 279              | 19990804    | 55 GL977657        | 3.1                 | 1 <=W          | 1 <=W                 | 1 <=W                | 1 <=W                 | 2 <=W                       | 2 <=W                       | 2 <=W            | 5 <=W                | 2 <=W                 | 4 <=W                  |
|   | 1              | 279              | 19990804    | 55 GL977658        | 3.1                 | 1 <=W          | 1 <=W                 | 1 <=W                | 1 <=W                 | 2 <=W                       | 2 <=W                       | 2 <=W            | 5 <=W                | 2 <=W                 | 4 <=W                  |
|   | 1              | 279              | 19990804    | 55 GL977659        | 3.1                 | 1 <=W          | 1 <=W                 | 1 <=W                | 1 <=W                 | 2 <=W                       | 2 <=W                       | 2 <=W            | 5 <=W                | 2 <=W                 | 4 <=W                  |
| NE side of Hawkins Island<br>(split sample)         | 1              | 468              | 19990804    | 55 GL977650        | 39.3                | 1 <=W          | 1 <=W                 | 1 <=W                | 1 <=W                 | 2 <=W                       | 2 <=W                       | 2 <=W            | 5 <=W                | 2 <=W                 | 4 <=W                  |
|   | 1              | 468              | 19990804    | 55 GL977651        | 39.3                | 1 <=W          | 1 <=W                 | 1 <=W                | 1 <=W                 | 2 <=W                       | 2 <=W                       | 2 <=W            | 5 <=W                | 2 <=W                 | 4 <=W                  |
|   | 1              | 468              | 19990804    | 55 GL977652        | 40                  | 1 <=W          | 1 <=W                 | 1 <=W                | 1 <=W                 | 2 <=W                       | 2 <=W                       | 2 <=W            | 5 <=W                | 2 <=W                 | 4 <=W                  |
|   | 1              | 468              | 19990804    | 51 GL977653        | 39.4                | 1 <=W          | 1 <=W                 | 1 <=W                | 1 <=W                 | 2 <=W                       | 2 <=W                       | 2 <=W            | 5 <=W                | 2 <=W                 | 4 <=W                  |
| SW of Peninsula                                     | 1              | 1469             | 19990804    | 55 GL977648        | 30.8                | 1 <=W          | 1 <=W                 | 1 <=W                | 1 <=W                 | 2 <=W                       | 2 <=W                       | 2 <=W            | 5 <=W                | 2 <=W                 | 4 <=W                  |
|   | 1              | 1469             | 19990804    | 55 GL977649        | 41.2                | 1 <=W          | 1 <=W                 | 1 <=W                | 1 <=W                 | 2 <=W                       | 2 <=W                       | 2 <=W            | 5 <=W                | 2 <=W                 | 4 <=W                  |
| STP - 500 m S                                       | 1              | 1409             | 19990804    | 51 GL977647        | 4.9                 | 1 <=W          | 1 <=W                 | 1 <=W                | 1 <=W                 | 2 <=W                       | 2 <=W                       | 2 <=W            | 5 <=W                | 2 <=W                 | 4 <=W                  |
| <b>Lowest Effect Level (ng/g)</b>                   |                |                  |             |                    |                     |                | 5                     | 5                    | 3                     | 7                           | 6                           | 2                |                      |                       |                        |
| <b>Severe Effect Level (ug/g organic carbon) **</b> |                |                  |             |                    |                     |                |                       |                      | 1                     |                             |                             | 91               |                      |                       |                        |

<W no measurable response

<T measurable trace amount, interpret with caution



Table 5: Concentrations of organochlorine pesticides and total PCBs in sediment collected from Lake Superior and the Spanish River, 1999

| Station Description                                 | Station Number | Endrin<br>ng/g | Endosulpham Sulphate<br>ng/g | Heptachlor Epoxide<br>ng/g | Heptachlor<br>ng/g | Mirex<br>ng/g | Oxychlorane<br>ng/g | o,p'-DDT<br>ng/g | p,p'-DDD<br>ng/g | p,p'-DDE<br>ng/g | p,p'-DDT<br>ng/g | Total PCB<br>ng/g | RMK |
|---|----------------|----------------|------------------------------|----------------------------|--------------------|---------------|---------------------|------------------|------------------|------------------|------------------|-------------------|-----|
| <b>Thunder Bay</b>                                  |                |                |                              |                            |                    |               |                     |                  |                  |                  |                  |                   |     |
| Kam R. at Mission River                             | 1 1 802        | 4 <W           | 4 <W                         | 1 <W                       | 1 <W               | 5 <W          | 2 <W                | 5 <W             | 5 <W             | 1 <W             | 15 <T            | 40 <T             |     |
| (split sample)                                      | 1 1 802        | 6 <T           | 4 <W                         | 1 <W                       | 1 <W               | 5 <W          | 2 <W                | 5 <W             | 5 <W             | 1 <W             | 5 <W             | 20 <W             |     |
| (split sample)                                      | 1 1 802        | 4 <W           | 4 <W                         | 1 <W                       | 1 <W               | 5 <W          | 2 <W                | 5 <W             | 5 <W             | 1 <W             | 5 <W             | 20 <W             |     |
| Kam River - mouth                                   | 1 1 802        | 4 <W           | 4 <W                         | 1 <W                       | 1 <W               | 5 <W          | 2 <W                | 5 <W             | 5 <W             | 1 <W             | 5 <W             | 100 <T            |     |
|   | 1 1 463        | 4 <W           | 4 <W                         | 1 <W                       | 1 <W               | 5 <W          | 4 <T                | 5 <W             | 5 <W             | 1 <W             | 5 <W             | 20 <W             |     |
|   | 1 1 463        | 4 <W           | 4 <W                         | 1 <W                       | 1 <W               | 5 <W          | 4 <T                | 5 <W             | 5 <W             | 1 <W             | 5 <W             | 20 <W             |     |
| Mission River - mouth                               | 1 1 463        | 4 <W           | 4 <W                         | 1 <W                       | 1 <W               | 5 <W          | 4 <T                | 5 <W             | 5 <W             | 1 <W             | 5 <W             | 20 <W             |     |
|   | 1 1 176        | 4 <W           | 4 <W                         | 1 <W                       | 1 <W               | 5 <W          | 4 <T                | 5 <W             | 5 <W             | 1 <W             | 5 <W             | 20 <W             |     |
|   | 1 1 176        | 4 <W           | 4 <W                         | 1 <W                       | 1 <W               | 5 <W          | 2 <W                | 5 <W             | 5 <W             | 1 <W             | 5 <W             | 20 <W             |     |
|   | 1 1 176        | 4 <W           | 4 <W                         | 1 <W                       | 1 <W               | 5 <W          | 2 <W                | 5 <W             | 5 <W             | 1 <W             | 5 <W             | 20 <W             |     |
| McKellar River - mouth                              | 1 1 462        | 4 <W           | 4 <W                         | 1 <W                       | 1 <W               | 5 <W          | 2 <W                | 5 <W             | 5 <W             | 1 <W             | 5 <W             | 40 <T             |     |
|   | 1 1 462        | 4 <W           | 4 <W                         | 1 <W                       | 1 <W               | 5 <W          | 2 <W                | 5 <W             | 5 <W             | 1 <W             | 5 <W             | 20 <W             |     |
|   | 1 1 462        | 4 <W           | 4 <W                         | 1 <W                       | 1 <W               | 5 <W          | 2 <W                | 5 <W             | 5 <W             | 1 <W             | 5 <W             | 20 <W             |     |
| North of Mission Bay Deposit                        | 1 1 464        | 4 <W           | 4 <W                         | 1 <W                       | 1 <W               | 5 <W          | 2 <W                | 5 <W             | 5 <W             | 1 <W             | 5 <W             | 20 <W             |     |
|   | 1 1 464        | 4 <W           | 4 <W                         | 1 <W                       | 1 <W               | 5 <W          | 2 <W                | 5 <W             | 5 <W             | 1 <W             | 5 <W             | 20 <W             |     |
|   | 1 1 464        | 4 <W           | 4 <W                         | 1 <W                       | 1 <W               | 5 <W          | 2 <W                | 5 <W             | 5 <W             | 1 <W             | 5 <W             | 20 <W             |     |
| Field Abitibi outfall (north of Bare Pt.)           | 1 1 466        | 4 <W           | 4 <W                         | 1 <W                       | 1 <W               | 5 <W          | 2 <W                | 5 <W             | 5 <W             | 1 <W             | 5 <W             | 20 <W             |     |
| Provincial Paper (outside filtration bed)           | 1 1 465        | 4 <W           | 4 <W                         | 1 <W                       | 1 <W               | 5 <W          | 12 <T               | 5 <W             | 5 <W             | 4 <T             | 10 <T            | 40 <T             |     |
|   | 1 1 465        | 4 <W           | 4 <W                         | 1 <W                       | 1 <W               | 5 <W          | 12 <T               | 5 <W             | 5 <W             | 4 <T             | 10 <T            | 40 <T             |     |
| Wellcome Island - Index Station                     | 1 1 284        | 8 <T           | 4 <W                         | 1 <W                       | 1 <W               | 5 <W          | 2 <W                | 5 <W             | 5 <W             | 1 <W             | 5 <W             | 60 <T             |     |
|   | 1 1 284        | 4 <W           | 4 <W                         | 1 <W                       | 1 <W               | 5 <W          | 2 <W                | 5 <W             | 5 <W             | 1 <W             | 5 <W             | 60 <T             |     |
|   | 1 1 284        | 4 <W           | 4 <W                         | 1 <W                       | 1 <W               | 5 <W          | 2 <W                | 5 <W             | 5 <W             | 1 <W             | 5 <W             | 100 <T            |     |
| <b>Peninsular Harbour</b>                           |                |                |                              |                            |                    |               |                     |                  |                  |                  |                  |                   |     |
| Beatty Cove - Index Station                         | 1 1 289        | 4 <W           | 4 <W                         | 1 <W                       | 1 <W               | 5 <W          | 4 <T                | 5 <W             | 5 <W             | 1 <W             | 5 <W             | 100 <T            |     |
|   | 1 1 289        | 4 <W           | 4 <W                         | 1 <W                       | 1 <W               | 5 <W          | 2 <W                | 5 <W             | 5 <W             | 1 <W             | 5 <W             | 100 <T            |     |
|   | 1 1 289        | 4 <W           | 4 <W                         | 1 <W                       | 1 <W               | 5 <W          | 2 <W                | 5 <W             | 5 <W             | 1 <W             | 5 <W             | 100 <T            |     |
| Jellifoe Cove - Near wharf                          | 1 1 276        | 4 <W           | 4 <W                         | 1 <W                       | 1 <W               | 5 <W          | 2 <W                | 5 <W             | 5 <W             | 1 <W             | 5 <W             | 100 <T            |     |
|   | 1 1 276        | 4 <W           | 4 <W                         | 1 <W                       | 1 <W               | 5 <W          | 6 <T                | 5 <W             | 5 <W             | 1 <W             | 5 <W             | 200               |     |
| Jellifoe Cove - Near wharf                          | 1 1 279        | 4 <W           | 4 <W                         | 1 <W                       | 1 <W               | 5 <W          | 2 <W                | 5 <W             | 5 <W             | 1 <W             | 5 <W             | 20 <W             |     |
|   | 1 1 279        | 4 <W           | 4 <W                         | 1 <W                       | 1 <W               | 5 <W          | 2 <W                | 5 <W             | 5 <W             | 1 <W             | 5 <W             | 20 <W             |     |
|   | 1 1 279        | 4 <W           | 4 <W                         | 1 <W                       | 1 <W               | 5 <W          | 2 <W                | 5 <W             | 5 <W             | 1 <W             | 5 <W             | 20 <W             |     |
| NE side of Hawkins Island                           | 1 1 468        | 4 <W           | 4 <W                         | 1 <W                       | 1 <W               | 5 <W          | 2 <W                | 5 <W             | 5 <W             | 1 <W             | 5 <W             | 80 <T             |     |
| (split sample)                                      | 1 1 468        | 4 <W           | 4 <W                         | 1 <W                       | 1 <W               | 5 <W          | 2 <W                | 5 <W             | 5 <W             | 1 <W             | 5 <W             | 100 <T            |     |
|   | 1 1 468        | 4 <W           | 4 <W                         | 1 <W                       | 1 <W               | 5 <W          | 2 <W                | 5 <W             | 5 <W             | 1 <W             | 5 <W             | 80 <T             |     |
| SW of Pennula                                       | 1 1 468        | 4 <W           | 4 <W                         | 1 <W                       | 1 <W               | 5 <W          | 2 <W                | 5 <W             | 5 <W             | 1 <W             | 5 <W             | 80 <T             |     |
|   | 1 1 469        | 4 <W           | 4 <W                         | 1 <W                       | 1 <W               | 5 <W          | 2 <W                | 5 <W             | 5 <W             | 1 <W             | 5 <W             | 20 <W             |     |
| STP - 500 m S                                       | 1 1 409        | 4 <W           | 4 <W                         | 1 <W                       | 1 <W               | 5 <W          | 2 <W                | 5 <W             | 5 <W             | 1 <W             | 5 <W             | 20 <W             |     |
| <b>Lowest Effect Level (ng/g)</b>                   |                | 3*             |                              | 5                          |                    |               |                     |                  |                  | 5                | 6                | 70                |     |
| <b>Severe Effect Level (ug/g organic carbon) **</b> |                |                |                              | 5                          |                    |               |                     |                  |                  | 19               | 71               | 130               |     |

<W no measurable response

<T measurable trace amount, interpret with caution



Table 6: PAH concentrations in sediment collected from Lake Superior and the Spanish River, 1999

| Station Description                       | Station Number | Date<br>YYYYMMDD | SMP<br>TYPE | Fied<br>Sample No | Sample<br>Depth (m) | Acenaphthene<br>ng/g (dry wt) | Acenaphthylene<br>ng/g (dry wt) | Anthracene<br>ng/g (dry wt) | Benzo(a)<br>anthracene<br>ng/g (dry wt) | Benzo(a)<br>pyrene<br>ng/g (dry wt) | Benzo(b)<br>fluoranthene<br>ng/g (dry wt) |
|---|----------------|------------------|-------------|-------------------|---------------------|-------------------------------|---------------------------------|-----------------------------|---|-------------------------------------|---|
| <b>Spanish River</b>                      |                |                  |             |                   |                     |                               |                                 |                             |   |                                     |   |
| Mouth of Spanish River                    | 14             | 1                | 400         | 19990810          | 55 GL977680         | 22                            | 20 <=W                          | 20 <=W                      | 20 <=W                                  | 40 <=W                              | 20 <=W                                    |
|   | 14             | 1                | 400         | 19990810          | 51 GL977681         | 2                             | 20 <=W                          | 20 <=W                      | 20 <=W                                  | 40 <=W                              | 20 <=W                                    |
|   | 14             | 1                | 400         | 19990810          | 51 GL977682         | 0                             | 20 <=W                          | 20 <=W                      | 20 <=W                                  | 40 <=W                              | 20 <=W                                    |
| Index Station                             | 14             | 1                | 39          | 19990811          | 51 GL977683         | 98                            | 20 <=W                          | 20 <=W                      | 20 <=W                                  | 40 <=W                              | 20 <=W                                    |
|   | 14             | 1                | 39          | 19990811          | 51 GL977684         | 98                            | 20 <=W                          | 20 <=W                      | 20 <=W                                  | 40 <=W                              | 20 <=W                                    |
|   | 14             | 1                | 39          | 19990811          | 51 GL977685         | 99                            | 120                             | 20 <=W                      | 20 <=W                                  | 80 <T                               | 80 <T                                     |
| Whalesback Channel                        | 14             | 1                | 39          | 19991019          | 54 GL953010         | 7.3                           | 20 <=W                          | 20 <=W                      | 20 <=W                                  | 40 <=W                              | 20 <=W                                    |
|   | 14             | 1                | 401         | 19990810          | 51 GL977670         | 22.7                          | 20 <=W                          | 20 <=W                      | 20 <=W                                  | 40 <=W                              | 20 <=W                                    |
|   | 14             | 1                | 401         | 19990810          | 51 GL977671         | 22.7                          | 20 <=W                          | 20 <=W                      | 20 <=W                                  | 40 <=W                              | 20 <=W                                    |
| Whalesback Channel (near Greenway Island) | 14             | 1                | 401         | 19990810          | 51 GL977672         | 14.9                          | 20 <=W                          | 20 <=W                      | 20 <=W                                  | 40 <=W                              | 20 <=W                                    |
|   | 14             | 1                | 209         | 19990810          | 51 GL977667         | 14.9                          | 20 <=W                          | 20 <=W                      | 20 <=W                                  | 40 <=W                              | 20 <=W                                    |
|   | 14             | 1                | 209         | 19990810          | 51 GL977668         | 15.6                          | 20 <=W                          | 20 <=W                      | 20 <=W                                  | 40 <=W                              | 20 <=W                                    |
| Aud Bay                                   | 14             | 1                | 402         | 19990810          | 51 GL977673         | 8.1                           | 20 <=W                          | 20 <=W                      | 20 <=W                                  | 40 <=W                              | 20 <=W                                    |
|   | 14             | 1                | 402         | 19990810          | 51 GL977674         | 8.1                           | 20 <=W                          | 20 <=W                      | 20 <=W                                  | 40 <=W                              | 20 <=W                                    |
|   | 14             | 1                | 402         | 19990810          | 55 GL977675         | 8.1                           | 20 <=W                          | 20 <=W                      | 20 <=W                                  | 40 <=W                              | 20 <=W                                    |
| Near Shanty Island                        | 14             | 1                | 402         | 19990810          | 55 GL977676         | 8.1                           | 20 <=W                          | 20 <=W                      | 20 <=W                                  | 40 <=W                              | 20 <=W                                    |
|   | 14             | 1                | 403         | 19990810          | 51 GL977677         | 11.7                          | 20 <=W                          | 20 <=W                      | 20 <=W                                  | 40 <=W                              | 20 <=W                                    |
|   | 14             | 1                | 403         | 19990810          | 51 GL977678         | 11.9                          | 20 <=W                          | 20 <=W                      | 20 <=W                                  | 40 <=W                              | 20 <=W                                    |
| Near Little Detroit                       | 14             | 1                | 404         | 19990810          | 51 GL977679         | 2.2                           | 20 <=W                          | 20 <=W                      | 20 <=W                                  | 40 <=W                              | 20 <=W                                    |
|   | 14             | 1                | 404         | 19990810          | 51 GL977683         | 33.7                          | 20 <=W                          | 20 <=W                      | 20 <=W                                  | 40 <=W                              | 100                                       |
|   | 14             | 1                | 404         | 19990810          | 51 GL977684         | 33.3                          | 20 <=W                          | 20 <=W                      | 20 <=W                                  | 40 <=W                              | 120                                       |
|   | 14             | 1                | 404         | 19990810          | 51 GL977685         | 33.2                          | 20 <=W                          | 20 <=W                      | 20 <=W                                  | 40 <=W                              | 60 <T                                     |
| <b>Niangua Bay</b>                        |                |                  |             |                   |                     |                               |                                 |                             |   |                                     |   |
| Downstream of Niangua R.                  | 1              | 1                | 458         | 19990731          | 51 GL977631         | 28.7                          | 20 <=W                          | 20 <=W                      | 20 <=W                                  | 40 <=W                              | 20 <=W                                    |
|   | 1              | 1                | 458         | 19990731          | 51 GL977632         | 28.7                          | 20 <=W                          | 20 <=W                      | 20 <=W                                  | 40 <=W                              | 20 <=W                                    |
| Niangua Bay - 30 m S of mill outfall      | 1              | 1                | 458         | 19990731          | 51 GL977633         | 28.6                          | 20 <=W                          | 20 <=W                      | 20 <=W                                  | 40 <=W                              | 20 <=W                                    |
|   | 1              | 1                | 459         | 19990731          | 51 GL977628         | 2.8                           | 20 <=W                          | 20 <=W                      | 20 <=W                                  | 40 <=W                              | 60 <T                                     |
|   | 1              | 1                | 459         | 19990731          | 51 GL977629         | 3                             | 20 <=W                          | 20 <=W                      | 20 <=W                                  | 40 <=W                              | 60 <T                                     |
| Niangua Bay - NW of Five Mile Pt          | 1              | 1                | 459         | 19990731          | 55 GL977630         | 3                             | 20 <=W                          | 20 <=W                      | 20 <=W                                  | 40 <=W                              | 20 <=W                                    |
|   | 1              | 1                | 461         | 19990731          | 51 GL977624         | 21.6                          | 20 <=W                          | 20 <=W                      | 20 <=W                                  | 40 <=W                              | 20 <=W                                    |
|   | 1              | 1                | 461         | 19990731          | 51 GL977625         | 21.6                          | 20 <=W                          | 20 <=W                      | 20 <=W                                  | 40 <=W                              | 20 <=W                                    |
|   | 1              | 1                | 461         | 19990731          | 55 GL977626         | 21.6                          | 20 <=W                          | 20 <=W                      | 20 <=W                                  | 40 <=W                              | 20 <=W                                    |
| Niangua Bay - Index Station               | 1              | 1                | 286         | 19990731          | 55 GL977627         | 21.6                          | 20 <=W                          | 20 <=W                      | 20 <=W                                  | 40 <=W                              | 20 <=W                                    |
|   | 1              | 1                | 286         | 19990731          | 51 GL977611         | 14                            | 20 <=W                          | 20 <=W                      | 20 <=W                                  | 40 <=W                              | 20 <=W                                    |
|   | 1              | 1                | 286         | 19990731          | 51 GL977612         | 14                            | 20 <=W                          | 20 <=W                      | 20 <=W                                  | 40 <=W                              | 20 <=W                                    |
|   | 1              | 1                | 286         | 19990731          | 51 GL977613         | 14                            | 20 <=W                          | 20 <=W                      | 20 <=W                                  | 40 <=W                              | 20 <=W                                    |
|   | 1              | 1                | 286         | 19991011          | 54 GL953003         | 12.2                          | 40 <T                           | 40 <T                       | 40 <T                                   | 40 <=W                              | 20 <=W                                    |
| Niangua Bay - West of Frog Island         | 1              | 1                | 869         | 19990731          | 51 GL97621          | 30                            | 20 <=W                          | 20 <=W                      | 20 <=W                                  | 40 <=W                              | 20 <=W                                    |
|   | 1              | 1                | 869         | 19990731          | 51 GL97622          | 30                            | 20 <=W                          | 20 <=W                      | 20 <=W                                  | 40 <=W                              | 20 <=W                                    |
|   | 1              | 1                | 869         | 19990731          | 51 GL97623          | 29.6                          | 20 <=W                          | 20 <=W                      | 20 <=W                                  | 40 <=W                              | 20 <=W                                    |



Table 6: PAH concentrations in sediment collected from Lake Superior and the Spanish River, 1999

| Station Description          | Station Number | Date<br>YYYYMMDD | SMP<br>TYPE | Field<br>Sample No | Sample<br>Depth (m) | Acenaphthene<br>ng/g (dry wt) | Acenaphthylene<br>ng/g (dry wt) | Anthracene<br>ng/g (dry wt) | Benzo(a)<br>anthracene<br>ng/g (dry wt) | Benzo(a)<br>pyrene<br>ng/g (dry wt) | Benzo(b)<br>fluoranthene<br>ng/g (dry wt) |
|------------------------------|----------------|------------------|-------------|--------------------|---------------------|-------------------------------|---------------------------------|-----------------------------|---|-------------------------------------|---|
| <b>Jackfish Bay</b>          |                |                  |             |                    |                     |                               |                                 |                             |   |                                     |   |
| Blackbird Creek - mouth      | 1              | 19990802         | 55          | GL977644           | 1.8                 | 20 <=W                        | 20 <=W                          | 20 <=W                      | 20 <=W                                  | 40 <=W                              | 20 <=W                                    |
|                              | 1              | 19990802         | 51          | GL977645           | 1.8                 | 20 <=W                        | 20 <=W                          | 20 <=W                      | 20 <=W                                  | 40 <=W                              | 20 <=W                                    |
|                              | 1              | 19990802         | 51          | GL977646           | 1.7                 | 20 <=W                        | 20 <=W                          | 20 <=W                      | 20 <=W                                  | 80 <T                               | 180                                       |
| Moberly Bay                  | 1              | 19990802         | 51          | GL977640           | 18.2                | 20 <=W                        | 20 <=W                          | 20 <=W                      | 20 <=W                                  | 80 <T                               | 140                                       |
|                              | 1              | 19990802         | 51          | GL977641           | 18.2                | 20 <=W                        | 20 <=W                          | 20 <=W                      | 20 <=W                                  | 80 <T                               | 140                                       |
|                              | 1              | 19990802         | 55          | GL977642           | 18.2                | 20 <=W                        | 20 <=W                          | 20 <=W                      | 20 <=W                                  | 80 <T                               | 140                                       |
|                              | 1              | 19990802         | 55          | GL977643           | 18.2                | 20 <=W                        | 20 <=W                          | 20 <=W                      | 20 <=W                                  | 80 <T                               | 140                                       |
| Downstream of Moberly Bay    | 1              | 19990802         | 51          | GL977637           | 34.2                | 20 <=W                        | 20 <=W                          | 20 <=W                      | 20 <=W                                  | 40 <=W                              | 80 <T                                     |
|                              | 1              | 19990802         | 51          | GL977638           | 31.5                | 20 <=W                        | 20 <=W                          | 20 <=W                      | 20 <=W                                  | 40 <=W                              | 40 <=W                                    |
|                              | 1              | 19990802         | 51          | GL977639           | 32                  | 20 <=W                        | 20 <=W                          | 20 <=W                      | 20 <=W                                  | 40 <=W                              | 20 <=W                                    |
|                              | 1              | 19990802         | 51          | GL977634           | 41.2                | 20 <=W                        | 20 <=W                          | 20 <=W                      | 20 <=W                                  | 40 <=W                              | 40 <=W                                    |
| Jackfish Bay                 | 1              | 19990731         | 51          | GL977635           | 41                  | 20 <=W                        | 20 <=W                          | 20 <=W                      | 20 <=W                                  | 40 <=W                              | 40 <=W                                    |
|                              | 1              | 19990731         | 51          | GL977636           | 40.6                | 20 <=W                        | 20 <=W                          | 20 <=W                      | 20 <=W                                  | 40 <=W                              | 40 <=W                                    |
|                              | 1              | 19990803         | 55          | GL977821           | 18.4                | 20 <=W                        | 20 <=W                          | 20 <=W                      | 20 <=W                                  | 40 <=W                              | 20 <=W                                    |
| Jackfish Bay - Index Station | 1              | 19990803         | 55          | GL977822           | 18.1                | 20 <=W                        | 20 <=W                          | 20 <=W                      | 20 <=W                                  | 40 <=W                              | 20 <=W                                    |
|                              | 1              | 19990803         | 51          | GL977823           | 18.6                | 20 <=W                        | 20 <=W                          | 20 <=W                      | 20 <=W                                  | 40 <=W                              | 20 <=W                                    |
|                              | 1              | 19991013         | 54          | GL955005           | 42.7                | 20 <=W                        | 20 <=W                          | 20 <=W                      | 20 <=W                                  | 40 <=W                              | 20 <=W                                    |
| <b>Pic River</b>             |                |                  |             |                    |                     |                               |                                 |                             |   |                                     |   |
| Pic River                    | 1              | 19990805         | 51          | GL977660           | 11.2                | 20 <=W                        | 20 <=W                          | 20 <=W                      | 20 <=W                                  | 40 <=W                              | 20 <=W                                    |
|                              | 1              | 19990805         | 51          | GL977661           | 11.2                | 20 <=W                        | 20 <=W                          | 20 <=W                      | 20 <=W                                  | 40 <=W                              | 20 <=W                                    |
|                              | 1              | 19990805         | 51          | GL977662           | 11.2                | 20 <=W                        | 20 <=W                          | 20 <=W                      | 20 <=W                                  | 40 <=W                              | 20 <=W                                    |
|                              | 1              | 19990805         | 55          | GL977663           | 11.9                | 20 <=W                        | 20 <=W                          | 20 <=W                      | 20 <=W                                  | 40 <=W                              | 20 <=W                                    |
| Pic River - mouth            | 1              | 19990805         | 55          | GL977664           | 11.9                | 20 <=W                        | 20 <=W                          | 20 <=W                      | 20 <=W                                  | 40 <=W                              | 20 <=W                                    |
|                              | 1              | 19990805         | 51          | GL977665           | 11.6                | 20 <=W                        | 20 <=W                          | 20 <=W                      | 20 <=W                                  | 40 <=W                              | 20 <=W                                    |
|                              | 1              | 19990805         | 51          | GL977666           | 12.1                | 20 <=W                        | 20 <=W                          | 20 <=W                      | 20 <=W                                  | 40 <=W                              | 20 <=W                                    |
| Pic River - South of mouth   | 1              | 19991015         | 51          | GL955001           | 2                   | 20 <=W                        | 20 <=W                          | 20 <=W                      | 20 <=W                                  | 40 <=W                              | 20 <=W                                    |
| Pic River - west of mouth    | 1              | 19991015         | 51          | GL955002           | 2                   | 20 <=W                        | 20 <=W                          | 20 <=W                      | 20 <=W                                  | 40 <=W                              | 20 <=W                                    |
| Lowest Effect Level (ug/g)   |                |                  |             |                    |                     |                               |                                 |                             |   |                                     |   |
| 5 were Effect Level          |                |                  |             |                    |                     |                               |                                 |                             |   |                                     |   |
| 5 were Effect Level          |                |                  |             |                    |                     |                               |                                 |                             |   |                                     |   |
| 5 were Effect Level          |                |                  |             |                    |                     |                               |                                 |                             |   |                                     |   |

<W no measurable response  
<T measurable trace amount. Interpret with caution



Table 6: PAH concentrations in sediment collected from Lake Superior and the Spanish River, 1999

| Station Description                       | Station Number | Benzo(a)fluoranthene<br>ng/g (dry wt.) | Chrysene<br>ng/g (dry wt.) | Dibenz(a,h)anthracene<br>ng/g (dry wt.) | Fluoranthene<br>ng/g (dry wt.) | Fluorene<br>ng/g (dry wt.) | Benzo(g,h,i)perylene<br>ng/g (dry wt.) | Indeno(1,2,3-cd)pyrene<br>ng/g (dry wt.) | Naphthalene<br>ng/g (dry wt.) | Phenanthrene<br>ng/g (dry wt.) | Pyrene<br>ng/g (dry wt.) | Total PAHs<br>ng/g (dry wt.) |
|---|----------------|--|----------------------------|---|--------------------------------|----------------------------|--|--|-------------------------------|--------------------------------|--------------------------|------------------------------|
| <b>Spanish River</b>                      |                |  |                            |   |                                |                            |  |  |                               |                                |                          |                              |
| Mouth of Spanish River                    | 14 1 400       | 20 <=W                                 | 20 <=W                     | 40 <=W                                  | 20 <=W                         | 20 <=W                     | 40 <=W                                 | 40 <=W                                   | 20 <=W                        | 20 <=W                         | 20 <=W                   | 0                            |
|   | 14 1 400       | 20 <=W                                 | 20 <=W                     | 40 <=W                                  | 20 <=W                         | 20 <=W                     | 40 <=W                                 | 40 <=W                                   | 20 <=W                        | 20 <=W                         | 20 <=W                   | 0                            |
|   | 14 1 400       | 20 <=W                                 | 20 <=W                     | 40 <=W                                  | 20 <=W                         | 20 <=W                     | 40 <=W                                 | 40 <=W                                   | 20 <=W                        | 20 <=W                         | 20 <=W                   | 0                            |
| Index Station                             | 14 1 39        | 20 <=W                                 | 20 <=W                     | 40 <=W                                  | 20 <=W                         | 20 <=W                     | 40 <=W                                 | 40 <=W                                   | 20 <=W                        | 20 <=W                         | 20 <=W                   | 0                            |
|   | 14 1 39        | 20 <=W                                 | 20 <=W                     | 40 <=W                                  | 20 <=W                         | 20 <=W                     | 40 <=W                                 | 40 <=W                                   | 20 <=W                        | 20 <=W                         | 20 <=W                   | 0                            |
|   | 14 1 39        | 80 <T                                  | 200                        | 40 <=W                                  | 880                            | 200                        | 40 <=W                                 | 40 <=W                                   | 40 <=W                        | 40 <T                          | 600                      | 120                          |
| Whalesback Channel                        | 14 1 39        | 20 <=W                                 | 20 <=W                     | 40 <=W                                  | 20 <=W                         | 20 <=W                     | 40 <=W                                 | 40 <=W                                   | 20 <=W                        | 20 <=W                         | 20 <=W                   | 3960                         |
|   | 14 1 401       | 20 <=W                                 | 20 <=W                     | 40 <=W                                  | 20 <=W                         | 20 <=W                     | 40 <=W                                 | 40 <=W                                   | 20 <=W                        | 20 <=W                         | 20 <=W                   | 0                            |
|   | 14 1 401       | 20 <=W                                 | 20 <=W                     | 40 <=W                                  | 20 <=W                         | 20 <=W                     | 40 <=W                                 | 40 <=W                                   | 20 <=W                        | 20 <=W                         | 20 <=W                   | 0                            |
|   | 14 1 401       | 20 <=W                                 | 20 <=W                     | 40 <=W                                  | 20 <=W                         | 20 <=W                     | 40 <=W                                 | 40 <=W                                   | 20 <=W                        | 20 <=W                         | 20 <=W                   | 0                            |
| Whalesback Channel (near Greenway Island) | 14 1 209       | 20 <=W                                 | 40 <T                      | 40 <=W                                  | 20 <=W                         | 20 <=W                     | 40 <=W                                 | 40 <=W                                   | 20 <=W                        | 20 <=W                         | 20 <=W                   | 80                           |
|   | 14 1 209       | 20 <=W                                 | 40 <T                      | 40 <=W                                  | 20 <=W                         | 20 <=W                     | 40 <=W                                 | 40 <=W                                   | 20 <=W                        | 20 <=W                         | 20 <=W                   | 40 <T                        |
|   | 14 1 209       | 20 <=W                                 | 20 <=W                     | 40 <=W                                  | 20 <=W                         | 20 <=W                     | 40 <=W                                 | 40 <=W                                   | 20 <=W                        | 20 <=W                         | 20 <=W                   | 40                           |
| Aird Bay                                  | 14 1 402       | 20 <=W                                 | 20 <=W                     | 40 <=W                                  | 20 <=W                         | 20 <=W                     | 40 <=W                                 | 40 <=W                                   | 20 <=W                        | 20 <=W                         | 20 <=W                   | 40                           |
|   | 14 1 402       | 20 <=W                                 | 20 <=W                     | 40 <=W                                  | 20 <=W                         | 20 <=W                     | 40 <=W                                 | 40 <=W                                   | 20 <=W                        | 20 <=W                         | 20 <=W                   | 40                           |
|   | 14 1 402       | 20 <=W                                 | 20 <=W                     | 40 <=W                                  | 20 <=W                         | 20 <=W                     | 40 <=W                                 | 40 <=W                                   | 20 <=W                        | 20 <=W                         | 20 <=W                   | 40                           |
| Near Shanly Island                        | 14 1 403       | 20 <=W                                 | 20 <=W                     | 40 <=W                                  | 20 <=W                         | 20 <=W                     | 40 <=W                                 | 40 <=W                                   | 20 <=W                        | 20 <=W                         | 20 <=W                   | 40                           |
|   | 14 1 403       | 20 <=W                                 | 20 <=W                     | 40 <=W                                  | 20 <=W                         | 20 <=W                     | 40 <=W                                 | 40 <=W                                   | 20 <=W                        | 20 <=W                         | 20 <=W                   | 40                           |
|   | 14 1 403       | 20 <=W                                 | 20 <=W                     | 40 <=W                                  | 20 <=W                         | 20 <=W                     | 40 <=W                                 | 40 <=W                                   | 20 <=W                        | 20 <=W                         | 20 <=W                   | 40                           |
| Near Little Detroit                       | 14 1 404       | 60 <T                                  | 60 <T                      | 40 <=W                                  | 80 <T                          | 40 <=W                     | 80 <T                                  | 80 <T                                    | 40 <=W                        | 40 <=W                         | 60 <T                    | 640                          |
|   | 14 1 404       | 20 <=W                                 | 40 <T                      | 40 <=W                                  | 40 <=W                         | 20 <=W                     | 40 <=W                                 | 40 <=W                                   | 20 <=W                        | 20 <=W                         | 40 <=W                   | 240                          |
|   | 14 1 404       | 40 <T                                  | 40 <T                      | 40 <=W                                  | 40 <=W                         | 40 <=W                     | 40 <=W                                 | 40 <=W                                   | 20 <=W                        | 20 <=W                         | 40 <=W                   | 260                          |
| <b>Nipigon Bay</b>                        |                |  |                            |   |                                |                            |  |  |                               |                                |                          |                              |
| Downstream of Nipigon R                   | 1 1 458        | 20 <=W                                 | 20 <=W                     | 40 <=W                                  | 20 <=W                         | 20 <=W                     | 40 <=W                                 | 40 <=W                                   | 20 <=W                        | 20 <=W                         | 20 <=W                   | 0                            |
|   | 1 1 458        | 20 <=W                                 | 20 <=W                     | 40 <=W                                  | 20 <=W                         | 20 <=W                     | 40 <=W                                 | 40 <=W                                   | 20 <=W                        | 20 <=W                         | 20 <=W                   | 0                            |
|   | 1 1 458        | 20 <=W                                 | 20 <=W                     | 40 <=W                                  | 20 <=W                         | 20 <=W                     | 40 <=W                                 | 40 <=W                                   | 20 <=W                        | 20 <=W                         | 20 <=W                   | 0                            |
| Nipigon Bay - 30 m S of mill outfall      | 1 1 459        | 40 <T                                  | 60 <T                      | 40 <=W                                  | 180                            | 20 <=W                     | 40 <=W                                 | 40 <=W                                   | 20 <=W                        | 20 <=W                         | 20 <=W                   | 680                          |
|   | 1 1 459        | 40 <T                                  | 80 <T                      | 40 <=W                                  | 180                            | 20 <=W                     | 40 <=W                                 | 40 <=W                                   | 20 <=W                        | 20 <=W                         | 20 <=W                   | 740                          |
| Nipigon Bay - NW of Five Mile Pt          | 1 1 459        | 20 <=W                                 | 40 <T                      | 40 <=W                                  | 140                            | 20 <=W                     | 40 <=W                                 | 40 <=W                                   | 20 <=W                        | 20 <=W                         | 20 <=W                   | 500                          |
|   | 1 1 461        | 20 <=W                                 | 40 <T                      | 40 <=W                                  | 40 <=W                         | 20 <=W                     | 40 <=W                                 | 40 <=W                                   | 20 <=W                        | 20 <=W                         | 20 <=W                   | 80                           |
|   | 1 1 461        | 20 <=W                                 | 20 <=W                     | 40 <=W                                  | 40 <=W                         | 20 <=W                     | 40 <=W                                 | 40 <=W                                   | 20 <=W                        | 20 <=W                         | 20 <=W                   | 80                           |
|   | 1 1 461        | 20 <=W                                 | 20 <=W                     | 40 <=W                                  | 60 <T                          | 20 <=W                     | 40 <=W                                 | 40 <=W                                   | 20 <=W                        | 20 <=W                         | 40 <=W                   | 200                          |
| Nipigon Bay - Index Station               | 1 1 286        | 20 <=W                                 | 20 <=W                     | 40 <=W                                  | 60 <T                          | 20 <=W                     | 40 <=W                                 | 40 <=W                                   | 20 <=W                        | 20 <=W                         | 20 <=W                   | 140                          |
|   | 1 1 286        | 20 <=W                                 | 20 <=W                     | 40 <=W                                  | 20 <=W                         | 20 <=W                     | 40 <=W                                 | 40 <=W                                   | 20 <=W                        | 20 <=W                         | 20 <=W                   | 0                            |
|   | 1 1 286        | 20 <=W                                 | 20 <=W                     | 40 <=W                                  | 20 <=W                         | 20 <=W                     | 40 <=W                                 | 40 <=W                                   | 20 <=W                        | 20 <=W                         | 20 <=W                   | 0                            |
|   | 1 1 286        | 20 <=W                                 | 40 <T                      | 40 <=W                                  | 80 <T                          | 20 <=W                     | 40 <=W                                 | 40 <=W                                   | 20 <=W                        | 20 <=W                         | 20 <=W                   | 60                           |
| Nipigon Bay - West of Frog Island         | 1 1 869        | 20 <=W                                 | 20 <=W                     | 40 <=W                                  | 20 <=W                         | 20 <=W                     | 40 <=W                                 | 40 <=W                                   | 20 <=W                        | 20 <=W                         | 20 <=W                   | 580                          |
|   | 1 1 869        | 20 <=W                                 | 20 <=W                     | 40 <=W                                  | 20 <=W                         | 20 <=W                     | 40 <=W                                 | 40 <=W                                   | 20 <=W                        | 20 <=W                         | 20 <=W                   | 0                            |
|   | 1 1 869        | 20 <=W                                 | 20 <=W                     | 40 <=W                                  | 20 <=W                         | 20 <=W                     | 40 <=W                                 | 40 <=W                                   | 20 <=W                        | 20 <=W                         | 20 <=W                   | 0                            |



Table 6: PAH concentrations in sediment collected from Lake Superior and the Spanish River, 1999

| Station Description                                | Station Number | Benzo(a)fluoranthene<br>ng/g (dry wt) | Chrysene<br>ng/g (dry wt) | Dibenz(a,h)anthracene<br>ng/g (dry wt) | Fluoranthene<br>ng/g (dry wt) | Fluorene<br>ng/g (dry wt) | Benzofluoranthene<br>ng/g (dry wt) | Indeno(1,2,3-cd)pyrene<br>ng/g (dry wt) | Naphthalene<br>ng/g (dry wt) | Phenanthrene<br>ng/g (dry wt) | Pyrene<br>ng/g (dry wt) | Total PAHs<br>ng/g (dry wt) |
|--|----------------|---------------------------------------|---------------------------|--|-------------------------------|---------------------------|------------------------------------|---|------------------------------|-------------------------------|-------------------------|-----------------------------|
| <b>Jackfish Bay</b>                                |                |                                       |                           |  |                               |                           |                                    |   |                              |                               |                         |                             |
| Blackbird Creek - mouth                            | 1 701          | 20 <W                                 | 20 <W                     | 40 <W                                  | 20 <W                         | 20 <W                     | 40 <W                              | 40 <W                                   | 20 <W                        | 20 <W                         | 20 <W                   | 0                           |
|  | 1 701          | 20 <W                                 | 20 <W                     | 40 <W                                  | 20 <W                         | 20 <W                     | 40 <W                              | 40 <W                                   | 20 <W                        | 20 <W                         | 20 <W                   | 0                           |
| Moberly Bay  | 1 701          | 20 <W                                 | 20 <W                     | 40 <W                                  | 40 <W                         | 40 <W                     | 40 <W                              | 40 <W                                   | 20 <W                        | 20 <W                         | 340                     | 1860                        |
|  | 1 702          | 60 <T                                 | 260                       | 40 <W                                  | 400                           | 20 <W                     | 40 <W                              | 40 <W                                   | 20 <W                        | 280                           | 300                     | 1700                        |
|  | 1 702          | 60 <T                                 | 260                       | 40 <W                                  | 400                           | 20 <W                     | 40 <W                              | 40 <W                                   | 20 <W                        | 280                           | 300                     | 1680                        |
|  | 1 702          | 80 <T                                 | 280                       | 40 <W                                  | 460                           | 20 <W                     | 40 <W                              | 40 <W                                   | 20 <W                        | 320                           | 340                     | 1940                        |
| Downstream of Moberly Bay                          | 1 710          | 40 <T                                 | 100                       | 40 <W                                  | 180                           | 20 <W                     | 40 <W                              | 40 <W                                   | 20 <W                        | 40 <T                         | 60 <T                   | 280                         |
|  | 1 710          | 20 <W                                 | 60 <T                     | 40 <W                                  | 40 <T                         | 20 <W                     | 40 <W                              | 40 <W                                   | 20 <W                        | 40 <T                         | 40 <T                   | 200                         |
|  | 1 710          | 20 <W                                 | 40 <T                     | 40 <W                                  | 40 <T                         | 20 <W                     | 40 <W                              | 40 <W                                   | 20 <W                        | 40 <T                         | 40 <T                   | 200                         |
| Jackfish Bay                                       | 1 451          | 20 <W                                 | 20 <W                     | 40 <T                                  | 60 <T                         | 20 <W                     | 40 <W                              | 40 <W                                   | 20 <W                        | 40 <T                         | 40 <T                   | 200                         |
|  | 1 451          | 20 <W                                 | 40 <T                     | 40 <W                                  | 60 <T                         | 20 <W                     | 40 <W                              | 40 <W                                   | 20 <W                        | 40 <T                         | 40 <T                   | 200                         |
| Jackfish Bay - Index Station                       | 1 288          | 20 <W                                 | 20 <W                     | 40 <W                                  | 20 <W                         | 20 <W                     | 40 <W                              | 40 <W                                   | 20 <W                        | 20 <W                         | 20 <W                   | 0                           |
|  | 1 288          | 20 <W                                 | 20 <W                     | 40 <W                                  | 20 <W                         | 20 <W                     | 40 <W                              | 40 <W                                   | 20 <W                        | 20 <W                         | 20 <W                   | 0                           |
|  | 1 288          | 20 <W                                 | 20 <W                     | 40 <W                                  | 40 <T                         | 20 <W                     | 40 <W                              | 40 <W                                   | 20 <W                        | 40 <T                         | 40 <T                   | 120                         |
| <b>Pic River</b>                                   |                |                                       |                           |  |                               |                           |                                    |   |                              |                               |                         |                             |
| Pic River  | 1 20           | 20 <W                                 | 20 <W                     | 40 <W                                  | 20 <W                         | 20 <W                     | 40 <W                              | 40 <W                                   | 20 <W                        | 20 <W                         | 20 <W                   | 0                           |
|  | 1 20           | 20 <W                                 | 20 <W                     | 40 <W                                  | 20 <W                         | 20 <W                     | 40 <W                              | 40 <W                                   | 20 <W                        | 20 <W                         | 20 <W                   | 40                          |
| Pic River - mouth                                  | 1 453          | 20 <W                                 | 20 <W                     | 40 <W                                  | 20 <W                         | 20 <W                     | 40 <W                              | 40 <W                                   | 20 <W                        | 20 <W                         | 20 <W                   | 0                           |
|  | 1 453          | 20 <W                                 | 20 <W                     | 40 <W                                  | 20 <W                         | 20 <W                     | 40 <W                              | 40 <W                                   | 20 <W                        | 20 <W                         | 20 <W                   | 0                           |
|  | 1 453          | 20 <W                                 | 20 <W                     | 40 <W                                  | 20 <W                         | 20 <W                     | 40 <W                              | 40 <W                                   | 20 <W                        | 20 <W                         | 20 <W                   | 0                           |
| Pic River - South of mouth                         | 1 453          | 20 <W                                 | 20 <W                     | 40 <W                                  | 20 <W                         | 20 <W                     | 40 <W                              | 40 <W                                   | 20 <W                        | 20 <W                         | 20 <W                   | 0                           |
| Pic River - west of mouth                          | 1 454          | 20 <W                                 | 20 <W                     | 40 <W                                  | 20 <W                         | 20 <W                     | 40 <W                              | 40 <W                                   | 20 <W                        | 20 <W                         | 20 <W                   | 0                           |
|  | 1 457          | 20 <W                                 | 20 <W                     | 40 <W                                  | 20 <W                         | 20 <W                     | 40 <W                              | 40 <W                                   | 20 <W                        | 20 <W                         | 20 <W                   | 0                           |
| <b>Lowest Effect Level (ug/g)</b>                  |                |                                       |                           |  |                               |                           |                                    |   |                              |                               |                         | 2                           |
| <b>Severe Effect Level (ug/g organic carbon) =</b> |                |                                       |                           |  |                               |                           |                                    |   |                              |                               |                         | 11,000                      |

<W no measurable response  
<T measurable trace amount, interpret with caution



Table 6: Concentration of PAHs in sediment collected from Lake Superior and the Spanish River, 1993

| Station Description  | Station Number | Date YYYYMMDD | SMP TYPE | Field Sample No | Sample Depth (m) | Acenaphthene ng/g (dry wt.) | Acenaphthylene ng/g (dry wt.) | Anthracene ng/g (dry wt.) | Benz(a) anthracene ng/g (dry wt.) | Benz(a) pyrene ng/g (dry wt.) | Benz(b) fluoranthene ng/g (dry wt.) |
|--|----------------|---------------|----------|-----------------|------------------|-----------------------------|-------------------------------|---------------------------|-----------------------------------|-------------------------------|-------------------------------------|
| <b>Thunder Bay</b>   |                |               |          |                 |                  |                             |                               |                           |                                   |                               |                                     |
| Kam R at Mission River   | 1              | 1 802         | 19900729 | 55 GL977604     | 8.2              | 20 <=W                      | 20 <=W                        | 20 <=W                    | 40 <T                             | 40 <=W                        | 20 <=W                              |
|  | 1              | 1 802         | 19900729 | 55 GL977605     | 8.2              | 20 <=W                      | 20 <=W                        | 20 <=W                    | 20 <=W                            | 40 <=W                        | 20 <=W                              |
|  | 1              | 1 802         | 19900729 | 55 GL977606     | 8.2              | 20 <=W                      | 20 <=W                        | 20 <=W                    | 20 <=W                            | 40 <=W                        | 20 <=W                              |
| Kam River - mouth  | 1              | 1 802         | 19900729 | 55 GL977607     | 8.1              | 20 <=W                      | 60 <T                         | 60 <T                     | 40 <T                             | 40 <=W                        | 60 <T                               |
|  | 1              | 1 463         | 19900729 | 55 GL977614     | 8.8              | 20 <=W                      | 20 <=W                        | 20 <=W                    | 20 <=W                            | 40 <=W                        | 20 <=W                              |
|  | 1              | 1 463         | 19900729 | 55 GL977615     | 8.9              | 20 <=W                      | 20 <=W                        | 20 <=W                    | 20 <=W                            | 40 <=W                        | 20 <=W                              |
|  | 1              | 1 463         | 19900729 | 55 GL977616     | 9.2              | 20 <=W                      | 20 <=W                        | 20 <=W                    | 20 <=W                            | 40 <=W                        | 40 <T                               |
| Mission River - mouth  | 1              | 1 176         | 19900729 | 51 GL977608     | 8.1              | 20 <=W                      | 20 <=W                        | 20 <=W                    | 20 <=W                            | 40 <=W                        | 20 <=W                              |
|  | 1              | 1 176         | 19900729 | 51 GL977609     | 8.1              | 20 <=W                      | 20 <=W                        | 20 <=W                    | 20 <=W                            | 40 <=W                        | 20 <=W                              |
|  | 1              | 1 176         | 19900729 | 51 GL977610     | 8.1              | 20 <=W                      | 20 <=W                        | 20 <=W                    | 20 <=W                            | 40 <=W                        | 20 <=W                              |
| McKellar River - mouth   | 1              | 1 462         | 19900729 | 55 GL977611     | 4.3              | 20 <=W                      | 20 <=W                        | 20 <=W                    | 20 <=W                            | 40 <=W                        | 20 <=W                              |
|  | 1              | 1 462         | 19900729 | 55 GL977612     | 4.3              | 20 <=W                      | 20 <=W                        | 20 <=W                    | 20 <=W                            | 40 <=W                        | 20 <=W                              |
|  | 1              | 1 462         | 19900729 | 55 GL977613     | 4.3              | 20 <=W                      | 20 <=W                        | 20 <=W                    | 20 <=W                            | 40 <=W                        | 20 <=W                              |
| North of Mission Bay Disposal                                  | 1              | 1 464         | 19900729 | 55 GL977601     | 6.1              | 20 <=W                      | 20 <=W                        | 20 <=W                    | 20 <=W                            | 40 <=W                        | 20 <=W                              |
|  | 1              | 1 464         | 19900729 | 55 GL977602     | 6.2              | 20 <=W                      | 20 <=W                        | 20 <=W                    | 20 <=W                            | 40 <=W                        | 20 <=W                              |
|  | 1              | 1 464         | 19900729 | 55 GL977603     | 6.2              | 20 <=W                      | 20 <=W                        | 20 <=W                    | 20 <=W                            | 40 <=W                        | 20 <=W                              |
| old Abitibi outfall (north of Bara Pl)                         | 1              | 1 465         | 19900729 | 55 GL977617     | 2.7              | 20 <=W                      | 20 <=W                        | 20 <=W                    | 20 <=W                            | 40 <=W                        | 20 <=W                              |
| Provincial Paper (outside filtration bed)                      | 1              | 1 465         | 19900729 | 51 GL977618     | 2.4              | 20 <=W                      | 20 <=W                        | 20 <=W                    | 20 <=W                            | 40 <=W                        | 20 <=W                              |
|  | 1              | 1 465         | 19900729 | 51 GL977619     | 2.4              | 20 <=W                      | 20 <=W                        | 20 <=W                    | 20 <=W                            | 40 <=W                        | 20 <=W                              |
| Welcome Island - Index Station                                 | 1              | 1 465         | 19900729 | 51 GL977620     | 2.4              | 20 <=W                      | 20 <=W                        | 40 <T                     | 60 <T                             | 40 <=W                        | 40 <T                               |
|  | 1              | 1 284         | 19900730 | 51 GL977601     | 17.1             | 20 <=W                      | 20 <=W                        | 20 <=W                    | 40 <T                             | 40 <=W                        | 60 <T                               |
|  | 1              | 1 284         | 19900730 | 51 GL977602     | 17.1             | 20 <=W                      | 20 <=W                        | 20 <=W                    | 40 <T                             | 40 <=W                        | 60 <T                               |
|  | 1              | 1 284         | 19900730 | 51 GL977603     | 17.2             | 20 <=W                      | 20 <=W                        | 20 <=W                    | 40 <T                             | 40 <=W                        | 40 <T                               |
| <b>Peninsula Harbour</b>                                       |                |               |          |                 |                  |                             |                               |                           |                                   |                               |                                     |
| Bentley Cove - Index Station                                   | 1              | 1 289         | 19900804 | 51 GL977826     | 19               | 20 <=W                      | 20 <=W                        | 20 <=W                    | 40 <T                             | 40 <=W                        | 40 <T                               |
|  | 1              | 1 289         | 19900804 | 51 GL977827     | 19.3             | 20 <=W                      | 20 <=W                        | 20 <=W                    | 20 <=W                            | 40 <=W                        | 20 <=W                              |
|  | 1              | 1 289         | 19900804 | 51 GL977828     | 109.2            | 20 <=W                      | 20 <=W                        | 20 <=W                    | 20 <=W                            | 40 <=W                        | 20 <=W                              |
| Jellicoe Cove - Near wharf                                     | 1              | 1 276         | 19900804 | 51 GL977654     | 6.7              | 20 <=W                      | 20 <=W                        | 20 <=W                    | 260                               | 200                           | 180                                 |
|  | 1              | 1 276         | 19900804 | 51 GL977655     | 6.7              | 20 <=W                      | 20 <=W                        | 80 <T                     | 240                               | 200                           | 160                                 |
|  | 1              | 1 276         | 19900804 | 51 GL977656     | 6.7              | 40 <T                       | 20 <=W                        | 120                       | 300                               | 240                           | 220                                 |
| Jellicoe Cove - Near wharf                                     | 1              | 1 279         | 19900804 | 55 GL977657     | 3.1              | 20 <=W                      | 20 <=W                        | 20 <=W                    | 20 <=W                            | 40 <=W                        | 20 <=W                              |
|  | 1              | 1 279         | 19900804 | 55 GL977658     | 3.1              | 20 <=W                      | 20 <=W                        | 20 <=W                    | 20 <=W                            | 40 <=W                        | 20 <=W                              |
|  | 1              | 1 279         | 19900804 | 55 GL977659     | 3.1              | 20 <=W                      | 20 <=W                        | 20 <=W                    | 20 <=W                            | 40 <=W                        | 20 <=W                              |
| NE side of Hawkins Island                                      | 1              | 1 468         | 19900804 | 55 GL977650     | 39.3             | 20 <=W                      | 20 <=W                        | 40 <T                     | 40 <T                             | 40 <=W                        | 40 <T                               |
|  | 1              | 1 468         | 19900804 | 55 GL977651     | 39.3             | 20 <=W                      | 20 <=W                        | 20 <=W                    | 20 <=W                            | 40 <=W                        | 20 <=W                              |
|  | 1              | 1 468         | 19900804 | 51 GL977652     | 40               | 20 <=W                      | 20 <=W                        | 20 <=W                    | 20 <=W                            | 40 <=W                        | 20 <=W                              |
|  | 1              | 1 468         | 19900804 | 51 GL977653     | 39.4             | 20 <=W                      | 20 <=W                        | 20 <=W                    | 20 <=W                            | 40 <=W                        | 20 <=W                              |
| SW of Peninsula  | 1              | 1 469         | 19900804 | 55 GL977648     | 30.8             | 20 <=W                      | 20 <=W                        | 20 <=W                    | 20 <=W                            | 40 <=W                        | 20 <=W                              |
|  | 1              | 1 469         | 19900804 | 55 GL977649     | 41.2             | 20 <=W                      | 20 <=W                        | 20 <=W                    | 20 <=W                            | 40 <=W                        | 20 <=W                              |
| STP - 500 m S  | 1              | 1 409         | 19900804 | 51 GL977647     | 4.9              | 20 <=W                      | 20 <=W                        | 20 <=W                    | 20 <=W                            | 40 <=W                        | 20 <=W                              |
| <b>Lowest Effect Level (ng/g)</b>                              |                |               |          |                 |                  |                             |                               |                           | 330                               | 370                           |                                     |
| <b>Severe Effect Level (ng/g organic carbon) <sup>10</sup></b> |                |               |          |                 |                  |                             |                               |                           |                                   |                               |                                     |

<W no measurable response

<T measurable trace amount; interpret with caution



Table 6: Concentration of PAHs in sediment collected from Lake Superior and the Spanish River, 1999

| Station Description                          | Station Number | Benzo(a)fluoranthene<br>ng/g (dry wt.) | Chrysene<br>ng/g (dry wt.) | Dibenz(a,h)anthracene<br>ng/g (dry wt.) | Fluoranthene<br>ng/g (dry wt.) | Fluorene<br>ng/g (dry wt.) | Benz(b)fluoranthene<br>ng/g (dry wt.) | Indeno(1,2,3-cd)pyrene<br>ng/g (dry wt.) | Naphthalene<br>ng/g (dry wt.) | Phenanthrene<br>ng/g (dry wt.) | Pyrene<br>ng/g (dry wt.) | Total PAHs<br>ng/g (dry wt.) |
|--|----------------|--|----------------------------|---|--------------------------------|----------------------------|---------------------------------------|--|-------------------------------|--------------------------------|--------------------------|------------------------------|
| <b>Thunder Bay</b>                           |                |  |                            |   |                                |                            |                                       |  |                               |                                |                          |                              |
| Kam R at Mission River                       | 1              | 802                                    | 20 <=W                     | 40 <T                                   | 120                            | 20 <=W                     | 20 <=W                                | 40 <=W                                   | 40 <T                         | 80 <T                          | 80 <T                    | 400                          |
| (split sample)                               | 1              | 802                                    | 20 <=W                     | 20 <=W                                  | 80 <T                          | 20 <=W                     | 20 <=W                                | 40 <=W                                   | 40 <T                         | 60 <T                          | 60 <T                    | 240                          |
| (split sample)                               | 1              | 802                                    | 20 <=W                     | 20 <=W                                  | 80 <T                          | 20 <=W                     | 20 <=W                                | 40 <=W                                   | 40 <T                         | 60 <T                          | 60 <T                    | 240                          |
| Kam River - mouth                            | 1              | 802                                    | 40 <T                      | 80 <T                                   | 320                            | 40 <T                      | 40 <T                                 | 40 <=W                                   | 60 <T                         | 240                            | 220                      | 1260                         |
|  | 1              | 463                                    | 20 <=W                     | 20 <=W                                  | 40 <T                          | 20 <=W                     | 20 <=W                                | 40 <=W                                   | 20 <=W                        | 40 <T                          | 40 <T                    | 120                          |
|  | 1              | 463                                    | 20 <=W                     | 20 <=W                                  | 40 <T                          | 20 <=W                     | 20 <=W                                | 40 <=W                                   | 20 <=W                        | 40 <T                          | 40 <T                    | 180                          |
| Mission River - mouth                        | 1              | 463                                    | 20 <=W                     | 20 <=W                                  | 60 <T                          | 20 <=W                     | 20 <=W                                | 40 <=W                                   | 20 <=W                        | 40 <T                          | 40 <T                    | 180                          |
|  | 1              | 176                                    | 20 <=W                     | 20 <=W                                  | 40 <T                          | 20 <=W                     | 20 <=W                                | 40 <=W                                   | 20 <=W                        | 40 <T                          | 20 <=W                   | 80                           |
|  | 1              | 176                                    | 20 <=W                     | 20 <=W                                  | 40 <T                          | 20 <=W                     | 20 <=W                                | 40 <=W                                   | 20 <=W                        | 40 <T                          | 40 <T                    | 120                          |
| McKellar River - mouth                       | 1              | 176                                    | 20 <=W                     | 20 <=W                                  | 40 <T                          | 20 <=W                     | 20 <=W                                | 40 <=W                                   | 20 <=W                        | 40 <T                          | 40 <T                    | 120                          |
|  | 1              | 462                                    | 20 <=W                     | 20 <=W                                  | 20 <=W                         | 20 <=W                     | 20 <=W                                | 40 <=W                                   | 20 <=W                        | 20 <=W                         | 20 <=W                   | 0                            |
|  | 1              | 462                                    | 20 <=W                     | 20 <=W                                  | 20 <=W                         | 20 <=W                     | 20 <=W                                | 40 <=W                                   | 20 <=W                        | 20 <=W                         | 20 <=W                   | 0                            |
|  | 1              | 462                                    | 20 <=W                     | 20 <=W                                  | 20 <=W                         | 20 <=W                     | 20 <=W                                | 40 <=W                                   | 20 <=W                        | 20 <=W                         | 20 <=W                   | 0                            |
| North of Mission Bay Disposal                | 1              | 464                                    | 20 <=W                     | 20 <=W                                  | 20 <=W                         | 20 <=W                     | 20 <=W                                | 40 <=W                                   | 20 <=W                        | 20 <=W                         | 20 <=W                   | 0                            |
|  | 1              | 464                                    | 20 <=W                     | 20 <=W                                  | 40 <T                          | 20 <=W                     | 20 <=W                                | 40 <=W                                   | 20 <=W                        | 20 <=W                         | 20 <=W                   | 40                           |
|  | 1              | 464                                    | 20 <=W                     | 20 <=W                                  | 20 <=W                         | 20 <=W                     | 20 <=W                                | 40 <=W                                   | 20 <=W                        | 20 <=W                         | 20 <=W                   | 0                            |
| old Abitibi outfall (north of Bare Pt.)      | 1              | 466                                    | 20 <=W                     | 20 <=W                                  | 20 <=W                         | 20 <=W                     | 20 <=W                                | 40 <=W                                   | 20 <=W                        | 20 <=W                         | 20 <=W                   | 0                            |
| Provincial Pallet (outside filtration bed)   | 1              | 465                                    | 20 <=W                     | 20 <=W                                  | 40 <T                          | 60 <T                      | 20 <=W                                | 40 <=W                                   | 60 <T                         | 80 <T                          | 40 <T                    | 240                          |
|  | 1              | 465                                    | 20 <=W                     | 20 <=W                                  | 40 <T                          | 100                        | 40 <=W                                | 40 <=W                                   | 40 <T                         | 100                            | 40 <T                    | 400                          |
| Welcome Island - Index Station               | 1              | 465                                    | 40 <T                      | 80 <T                                   | 300                            | 20 <=W                     | 20 <=W                                | 40 <=W                                   | 120                           | 240                            | 240                      | 1160                         |
|  | 1              | 284                                    | 40 <T                      | 60 <T                                   | 140                            | 20 <=W                     | 20 <=W                                | 40 <=W                                   | 80 <T                         | 120                            | 120                      | 660                          |
|  | 1              | 284                                    | 40 <T                      | 60 <T                                   | 140                            | 20 <=W                     | 20 <=W                                | 40 <=W                                   | 60 <T                         | 100                            | 120                      | 620                          |
|  | 1              | 284                                    | 40 <T                      | 60 <T                                   | 100                            | 20 <=W                     | 20 <=W                                | 40 <=W                                   | 40 <T                         | 80 <T                          | 80 <T                    | 460                          |
| <b>Peninsula Harbour</b>                     |                |  |                            |   |                                |                            |                                       |  |                               |                                |                          |                              |
| Beatty Cove - Index Station                  | 1              | 289                                    | 40 <T                      | 40 <T                                   | 120                            | 20 <=W                     | 20 <=W                                | 40 <=W                                   | 20 <=W                        | 80 <T                          | 80 <T                    | 440                          |
|  | 1              | 289                                    | 20 <=W                     | 20 <=W                                  | 40 <T                          | 20 <=W                     | 20 <=W                                | 40 <=W                                   | 20 <=W                        | 40 <T                          | 40 <T                    | 120                          |
|  | 1              | 289                                    | 20 <=W                     | 40 <T                                   | 60 <T                          | 20 <=W                     | 20 <=W                                | 40 <=W                                   | 20 <=W                        | 60 <T                          | 60 <T                    | 220                          |
| Jellicoe Cove - Near wharf                   | 1              | 276                                    | 140                        | 300                                     | 520                            | 60 <T                      | 60 <T                                 | 120 <T                                   | 180                           | 440                            | 460                      | 3140                         |
|  | 1              | 276                                    | 120                        | 240                                     | 420                            | 60 <T                      | 60 <T                                 | 120 <T                                   | 220                           | 460                            | 520                      | 3020                         |
|  | 1              | 276                                    | 160                        | 300                                     | 600                            | 80 <T                      | 80 <T                                 | 160 <T                                   | 160                           | 580                            | 520                      | 3680                         |
| Jellicoe Cove - Near wharf                   | 1              | 279                                    | 20 <=W                     | 20 <=W                                  | 20 <=W                         | 20 <=W                     | 20 <=W                                | 40 <=W                                   | 20 <=W                        | 20 <=W                         | 20 <=W                   | 0                            |
|  | 1              | 279                                    | 20 <=W                     | 20 <=W                                  | 60 <T                          | 20 <=W                     | 20 <=W                                | 40 <=W                                   | 20 <=W                        | 40 <T                          | 40 <T                    | 140                          |
|  | 1              | 279                                    | 20 <=W                     | 20 <=W                                  | 20 <=W                         | 20 <=W                     | 20 <=W                                | 40 <=W                                   | 20 <=W                        | 20 <=W                         | 20 <=W                   | 0                            |
| NE side of Hawkins Island                    | 1              | 468                                    | 40 <T                      | 60 <T                                   | 120                            | 20 <=W                     | 20 <=W                                | 40 <=W                                   | 20 <=W                        | 120                            | 80 <T                    | 540                          |
| (split sample)                               | 1              | 468                                    | 20 <=W                     | 20 <=W                                  | 40 <T                          | 20 <=W                     | 20 <=W                                | 40 <=W                                   | 20 <=W                        | 20 <=W                         | 40 <T                    | 80                           |
|  | 1              | 468                                    | 20 <=W                     | 20 <=W                                  | 40 <T                          | 20 <=W                     | 20 <=W                                | 40 <=W                                   | 20 <=W                        | 40 <T                          | 20 <=W                   | 80                           |
| SW of Peninsula                              | 1              | 469                                    | 20 <=W                     | 20 <=W                                  | 40 <=W                         | 20 <=W                     | 20 <=W                                | 40 <=W                                   | 20 <=W                        | 20 <=W                         | 20 <=W                   | 40                           |
|  | 1              | 469                                    | 20 <=W                     | 20 <=W                                  | 40 <=W                         | 20 <=W                     | 20 <=W                                | 40 <=W                                   | 20 <=W                        | 20 <=W                         | 20 <=W                   | 0                            |
|  | 1              | 469                                    | 20 <=W                     | 20 <=W                                  | 20 <=W                         | 20 <=W                     | 20 <=W                                | 40 <=W                                   | 20 <=W                        | 20 <=W                         | 20 <=W                   | 0                            |
| STP - 500 m S                                | 1              | 409                                    | 20 <=W                     | 20 <=W                                  | 20 <=W                         | 20 <=W                     | 20 <=W                                | 40 <=W                                   | 20 <=W                        | 20 <=W                         | 20 <=W                   | 0                            |
| Severe Effect Level (ug/g organic carbon) ** |                | 240                                    | 340                        | 60                                      | 750                            | 160                        | 170                                   | 300                                      | 560                           | 400                            | 400                      | 4000                         |
| Lower Effect Level (ug/g organic carbon) **  |                | 240                                    | 340                        | 60                                      | 750                            | 160                        | 170                                   | 300                                      | 560                           | 400                            | 400                      | 11,000                       |

<W no measurable response  
<T measurable trace amount. Interpret with caution



Table 7: Concentration (pg/g dry wt.) of polychlorinated dibenzo-p-dioxins and polychlorinated dibenzofurans in sediment collected from Lake Superior and the Spanish River, 1999. (n=1)

| Station No       | Mouth of Spanish River | Spanish Index Station | Nipigon Bay S of mill outfall | Nipigon Bay Index Station | Blackbird Creek | Jackfish Bay Index Station | Pic River |
|------------------|------------------------|-----------------------|-------------------------------|---------------------------|-----------------|----------------------------|-----------|
| Sample Depth (m) | Spanish River          | Index Station         | S of mill outfall             | Index Station             |                 |                            |           |
|                  | 400                    | 39                    | 459                           | 286                       | 701             | 288                        | 453       |
|                  | 2.2                    | 9.8                   | 2.8                           | 14                        | 18.2            | 18.4                       | 11.9      |
| 2378 TCDF        | 13                     | 320                   | 280                           | 14                        | 0.9 <           | 3 <                        | 0.7 <     |
| 12378 PCDF       | 2 <                    | 6 <                   | 6.1                           | 0.5 <                     | 0.5 <           | 0.2 <                      | 2 <       |
| 23478 PCDF       | 1 <                    | 7 <                   | 5.8                           | 0.7 <                     | 0.4 <           | 0.4 <                      | 1 <       |
| 123478 HxCDF     | 2 <                    | 7 <                   | 7.6                           | 1 <                       | 1 <             | 0.4 <                      | 3 <       |
| 1234578 HxCDF    | 2 <                    | 3 <                   | 2.4                           | 0.8 <                     | 0.8 <           | 0.5 <                      | 1 <       |
| 234578 HxCDF     | 3 <                    | 1 <                   | 1 <                           | 1 <                       | 1 <             | 1 <                        | 2 <       |
| 123789 HxCDF     | 1 <                    | 2 <                   | 2 <                           | 0.7 <                     | 0.8 <           | 0.4 <                      | 1 <       |
| 1234578 HxCDF    | 2 <                    | 10 <                  | 11                            | 5.3                       | 4.1             | 1 <                        | 5.9       |
| 1234789 HxCDF    | 1 <                    | 2 <                   | 2 <                           | 0.4 <                     | 0.5 <           | 0.1 <                      | 0.6 <     |
| OCDF (total)     | 4 <                    | 20 <                  | 21                            | 7.1                       | 5.8             | 1 <                        | 9.4       |
| 2378 TCDF        | 1 <                    | 18                    | 15                            | 0.4 <                     | 0.5 <           | 0.6 <                      | 3 <       |
| 12378 PCDF       | 1 <                    | 2 <                   | 1 <                           | 1 <                       | 0.8 <           | 0.7 <                      | 1 <       |
| 123478 HxCDF     | 1 <                    | 2 <                   | 1 <                           | 0.9 <                     | 0.7 <           | 0.5 <                      | 1 <       |
| 12378 HxCDF      | 0.7 <                  | 4 <                   | 4.3                           | 2.8                       | 1.3             | 0.3 <                      | 1.5       |
| 123789 HxCDF     | 1 <                    | 3 <                   | 3 <                           | 2.3                       | 1 <             | 0.4 <                      | 2 <       |
| 1234578 HxCDF    | 7 <                    | 55                    | 68                            | 31                        | 13              | 2 <                        | 26        |
| OCDF (total)     | 62                     | 690                   | 910                           | 1500                      | 92              | 13                         | 100       |
| T4CDF (total)    | 16                     | 550                   | 116                           | 8.3                       | 1.20            | 3.7                        | 13        |
| PCDF (total)     | 2 <                    | 10                    | 14                            | 4.5                       | 3.13            | 0.7 <                      | 16.17     |
| H7CDF (total)    | 3 <                    | 12                    | 13                            | 12                        | 1.1             | 1 <                        | 5.12      |
| T4CDD (total)    | 2 <                    | 14                    | 12                            | 50                        | 4.1             | 1 <                        | 11.12     |
| PCDD (total)     | 1 <                    | 20                    | 12                            | 2.2                       | 0.8 <           | 0.6 <                      | 5.12      |
| H6CDD (total)    | 1 <                    | 2.5                   | 1.1                           | 2 <                       | 2.2             | 0.7 <                      | 1 <       |
| H7CDD (total)    | 6.1                    | 19                    | 12                            | 66                        | 7.5             | 0.5 <                      | 22.15     |
| PCB081           | 0.4 <                  | 0.53                  | 0.9 <                         | 5.2                       | 0.5 <           | 0.3 <                      | 0.8 <     |
| PCB077           | 1 <                    | 12                    | 17                            | 11                        | 10              | 2 <                        | 19        |
| PCB123           | 1.7                    | 36                    | 21                            | 5.4                       | 5.9             | 2 <                        | 19        |
| PCB118           | 55                     | 460                   | 570                           | 12000                     | 120             | 28                         | 280       |
| PCB114           | 1 <                    | 9 <                   | 11                            | 260                       | 2.7             | 1 <                        | 7.9       |
| PCB105           | 22                     | 170                   | 210                           | 4300                      | 52              | 10 <                       | 130       |
| PCB126           | 0.5 <                  | 2.4                   | 4.1                           | 26                        | 1 <             | 0.5 <                      | 3.4       |
| PCB167           | 1.5                    | 24                    | 43                            | 1000                      | 6.9             | 3 <                        | 20        |
| PCB156           | 6.6                    | 62                    | 100                           | 2500                      | 23              | 6.2                        | 56        |
| PCB157           | 2                      | 15                    | 25                            | 510                       | 4 <             | 2 <                        | 13        |
| PCB169           | 0.1 <                  | 0.3 <                 | 0.6 <                         | 1 <                       | 0.6 <           | 0.1 <                      | 1 <       |
| PCB189           | 0.52                   | 4.6                   | 5.5                           | 140                       | 2 <             | 1 <                        | 9.5       |
| TOC mg/g         | 2                      | 13                    | 39                            | 120                       | 14              | 6                          | 51        |
| TEQ pg/g         | 13                     | 510                   | 49.2                          | 10.5                      | 0.3             | 0.3                        | 5.9       |

(n=) - number of isomers detected in this congener group  
 < Actual result is less than reported value



**Table 7: Concentration (pg/g dry wt.) of polychlorinated dibenzo-p-dioxins and polychlorinated dibenzofurans in sediment collected from Lake Superior and the Spanish River, 1999. (n=1)**

|                  | Kam River at<br>Mission River | Provincial Paper | Welcome Island | Beatty Cove<br>Index Station |
|------------------|-------------------------------|------------------|----------------|------------------------------|
| Station No.      | 802                           | 465              | 284            | 289                          |
| Sample Depth (m) | 8.2                           | 2.4              | 17.1           | 19                           |
| 2378 TCDF        | 1.6                           | 22               | 22             | 11                           |
| 12378PCDF        | 0.3 <                         | 0.7 <            | 4.4            | 2.1                          |
| 23478PCDF        | 0.4 <                         | 0.6 <            | 4.6            | 1.9                          |
| 123478 H6CDF     | 0.5 <                         | 0.8 <            | 9.2            | 3.5                          |
| 123678 H6CDF     | 0.7 <                         | 1 <              | 10             | 1 <                          |
| 234678 H6CDF     | 1 <                           | 2 <              | 2 <            | 1 <                          |
| 123789 H6CDF     | 0.5 <                         | 0.7 <            | 5.9            | 0.8 <                        |
| 1234678 HpCDF    | 6.8                           | 8                | 360            | 5.1                          |
| 1234789 HpCDF    | 0.5 <                         | 0.6 <            | 6.4            | 0.98                         |
| O8CDF (total)    | 19                            | 19               | 350            | 8.7                          |
| 2378 TCDD        | 0.6 <                         | 2.3              | 3.9            | 1.8                          |
| 12378 PCDD       | 0.7 <                         | 2 <              | 4.8            | 1 <                          |
| 123478 HxCDD     | 0.6 <                         | 2 <              | 3.9            | 1 <                          |
| 123678 HxCDD     | 1 <                           | 6                | 18             | 1 <                          |
| 123789 HxCDD     | 1 <                           | 4.6              | 9.1            | 1.5                          |
| 1234678 HpCDD    | 30                            | 29               | 260            | 14                           |
| O8CDD (total)    | 260                           | 190              | 1700           | 84                           |
| T4CDF (total)    | 20 19                         | 38 19            | 77 117         | 34 118                       |
| P5CDF (total)    | 2.2 12                        | 2.4 11           | 80 110         | 13 18                        |
| H6CDF (total)    | 4.2 13                        | 6.7 13           | 250 18         | 11 17                        |
| H7CDF (total)    | 18 12                         | 22 12            | 770 13         | 11 13                        |
| T4CDD (total)    | 2 <                           | 7.4 14           | 26 17          | 4.2 13                       |
| P5CDD (total)    | 1.1 11                        | 1.3 12           | 29 18          | 2 11                         |
| H6CDD (total)    | 6.1 12                        | 42 15            | 130 18         | 13 16                        |
| H7CDD (total)    | 59 12                         | 55 12            | 490 12         | 34 12                        |
| PCB081           | 2 <                           | 2                | 8.4            | 1 <                          |
| PCB077           | 43                            | 47               | 220            | 22                           |
| PCB123           | 12                            | 84               | 100            | 110                          |
| PCB118           | 420                           | 3000             | 3500           | 1300                         |
| PCB114           | 12                            | 72               | 78             | 21                           |
| PCB105           | 180                           | 1200             | 1400           | 370                          |
| PCB126           | 1 <                           | 4 <              | 15             | 6.9                          |
| PCB167           | 11                            | 96               | 150            | 210                          |
| PCB156           | 30                            | 290              | 440            | 530                          |
| PCB157           | 6 <                           | 67               | 100            | 43                           |
| PCB169           | 0.3 <                         | 0.3 <            | 1 <            | 1 <                          |
| PCB189           | 2 <                           | 10 <             | 33             | 140                          |
| TOC (mg/g)       | 22                            | 380              | 28             | 34                           |
| TEQ (pg/g)       | 0.64                          | 6.60             | 27.84          | 5.85                         |

l(no.) - number of isomers detected in this congener group

< Compound was below the detection limit











Appendix 2: Water quality data for field and travel blanks collected for the Lake Superior Harbour Water Quality Monitoring Survey, 1999

| Survey Area   | Field#   | Date     | ALUT<br>µg/L  | ASUT<br>µg/L | BAUT<br>µg/L  | BEUT<br>µg/L  | CDUT<br>µg/L  | CLDUR<br>mg/L | COUT<br>µg/L  | CRUT<br>µg/L |
|---------------|----------|----------|---------------|--------------|---------------|---------------|---------------|---------------|---------------|--------------|
| Spanish River | GL978424 | 19990523 | 0.36 ± 10.000 | 0.0005 <W    | 0.013 ± 0.500 | 0.004 ± 1.000 | 0.139 ± 0.500 | 0.2 <W        | 0.003 ± 1.000 | 0.11 ± 5.000 |
|               | F        | GL978424 | 0.25 ± 10.000 | 0.002 <W     | 0.238 ± 0.500 | 0.006 ± 1.000 | 0.002 ± 0.510 | 0.2 <W        | 0.032 ± 1.000 | 0.03 ± 5.000 |
|               | F        | GL978424 | 0.11 ± 10.000 | 0.0005 <W    | 0.018 ± 0.500 | 0.011 ± 1.000 | 0.019 ± 0.510 | 0.2 <W        | 0.023 ± 1.000 | 0.01 ± 5.000 |
|               | T        | GL978424 | 1.00 ± 1      | 0.0005 <W    | 0.010 ± 0.500 | 0.100 ± 0.500 | 0.000 ± 0.05  | 0.2 <W        | 0.000 ± 0.1   | 0.20 ± 0.5   |
|               | F        | GL978424 | 0.00 ± 1      | 0.0005 <W    | 0.010 ± 0.500 | 0.000 ± 0.1   | 0.010 ± 0.05  | 0.2 <W        | 0.000 ± 0.1   | 0.00 ± 0.5   |
|               | F        | GL954054 | 1.00 ± 1      | 0.0005 <W    | 0.010 ± 0.500 | 0.000 ± 0.1   | 0.010 ± 0.05  | 0.2 <W        | 0.000 ± 0.1   | 0.20 ± 0.5   |
|               | F        | GL954054 | 0.00 ± 1      | 0.0005 <W    | 0.010 ± 0.500 | 0.000 ± 0.1   | 0.010 ± 0.05  | 0.2 <W        | 0.000 ± 0.1   | 0.10 ± 0.5   |
|               | H        | GL954054 | 1.00 ± 1      | 0.0005 <W    | 0.010 ± 0.500 | 0.000 ± 0.1   | 0.010 ± 0.05  | 0.2 <W        | 0.000 ± 0.1   | 0.10 ± 0.5   |
|               | F        | GL978432 | 0.87 ± 1      | 0.0005 <W    | 0.035 ± 0.05  | 0.013 ± 0.1   | 0.000 ± 0.05  | 0.2 <W        | 0.013 ± 0.1   | 0.02 ± 0.5   |
|               | F        | GL978432 | 1.00 ± 1      | 0.0005 <W    | 0.008 ± 0.05  | 0.005 ± 0.1   | 0.004 ± 0.05  | 0.2 <W        | 0.002 ± 0.1   | 0.01 ± 0.5   |
| Nipigon Bay   | GL978421 | 19990522 | 0.00 ± 1      | 0.0005 <W    | 0.060 ± 0.05  | 0.000 ± 0.1   | 0.000 ± 0.05  | 0.2 <W        | 0.000 ± 0.1   | 0.00 ± 0.5   |
|               | F        | GL978421 | 0.00 ± 1      | 0.0005 <W    | 0.010 ± 0.05  | 0.000 ± 0.1   | 0.000 ± 0.05  | 0.2 <W        | 0.000 ± 0.1   | 0.00 ± 0.5   |
|               | H        | GL978421 | 1.00 ± 1      | 0.0005 <W    | 0.010 ± 0.05  | 0.000 ± 0.1   | 0.000 ± 0.05  | 0.2 <W        | 0.000 ± 0.1   | 0.00 ± 0.5   |
|               | F        | GL954021 | 1.00 ± 1      | 0.0005 <W    | 0.040 ± 0.05  | 0.000 ± 0.1   | 0.000 ± 0.05  | 0.2 <W        | 0.000 ± 0.1   | 0.30 ± 0.5   |
|               | H        | GL954022 | 0.00 ± 1      | 0.0005 <W    | 0.000 ± 0.05  | 0.000 ± 0.1   | 0.010 ± 0.05  | 0.2 <W        | 0.000 ± 0.1   | 0.50 ± 0.5   |
|               | F        | GL954023 | 1.00 ± 1      | 0.0005 <W    | 0.000 ± 0.05  | 0.000 ± 0.1   | 0.010 ± 0.05  | 0.2 <W        | 0.000 ± 0.1   | 0.50 ± 0.5   |
|               | H        | GL978407 | 0.52 ± 10.000 | 0.0005 <W    | 0.075 ± 0.500 | 0.024 ± 1.000 | 0.061 ± 0.500 | 0.2 <W        | 0.035 ± 1.000 | 0.08 ± 5.000 |
|               | F        | GL978408 | 0.11 ± 10.000 | 0.0005 <W    | 0.002 ± 0.500 | 0.008 ± 1.000 | 0.057 ± 0.500 | 0.2 <W        | 0.022 ± 1.000 | 0.07 ± 5.000 |
|               | F        | GL978430 | 1.00 ± 1      | 0.0005 <W    | 0.160 ± 0.05  | 0.000 ± 0.1   | 0.010 ± 0.05  | 0.2 <W        | 0.000 ± 0.1   | 0.00 ± 0.5   |
|               | H        | GL978431 | 0.15 ± 1      | 0.0005 <W    | 0.014 ± 0.05  | 0.015 ± 0.1   | 0.019 ± 0.05  | 0.2 <W        | 0.013 ± 0.1   | 0.09 ± 0.5   |
| Pac River     | GL978412 | 19990502 | 0.00 ± 1      | 0.0005 <W    | 0.000 ± 0.05  | 0.000 ± 0.1   | 0.010 ± 0.05  | 0.2 <W        | 0.000 ± 0.1   | 0.10 ± 0.5   |
|               | F        | GL978412 | 0.00 ± 1      | 0.0005 <W    | 0.000 ± 0.05  | 0.000 ± 0.1   | 0.010 ± 0.05  | 0.2 <W        | 0.000 ± 0.1   | 0.10 ± 0.5   |
|               | H        | GL978412 | 0.00 ± 1      | 0.0005 <W    | 0.000 ± 0.05  | 0.000 ± 0.1   | 0.010 ± 0.05  | 0.2 <W        | 0.000 ± 0.1   | 0.10 ± 0.5   |
|               | F        | GL978415 | 2.02 ± 12.000 | 0.0005 <W    | 0.067 ± 0.500 | 0.022 ± 1.000 | 0.101 ± 0.500 | 0.2 <W        | 0.013 ± 1.000 | 0.21 ± 5.000 |
|               | T        | GL978415 | 0.14 ± 10.000 | 0.0005 <W    | 0.017 ± 0.500 | 0.031 ± 1.000 | 0.084 ± 0.500 | 0.2 <W        | 0.007 ± 1.000 | 0.20 ± 5.000 |
|               | F        | GL978418 | 0.22 ± 1      | 0.0005 <W    | 0.013 ± 0.05  | 0.005 ± 0.1   | 0.018 ± 0.05  | 0.2 <W        | 0.016 ± 0.1   | 0.02 ± 0.5   |
|               | T        | GL978418 | 0.00 ± 1      | 0.0005 <W    | 0.091 ± 0.05  | 0.005 ± 0.1   | 0.049 ± 0.05  | 0.2 <W        | 0.010 ± 0.1   | 0.29 ± 0.5   |
|               | F        | GL978418 | 0.14 ± 1      | 0.0005 <W    | 0.009 ± 0.05  | 0.023 ± 0.1   | 0.020 ± 0.05  | 0.2 <W        | 0.009 ± 0.1   | 0.17 ± 0.5   |
|               | H        | GL954045 | 6.00 ± 1      | 0.0005 <W    | 0.010 ± 0.05  | 0.200 ± 0.4   | 0.010 ± 0.06  | 0.2 <W        | 0.000 ± 0.1   | 0.10 ± 0.5   |
|               | F        | GL978446 | 0.66 ± 10.000 | 0.0005 <W    | 0.068 ± 0.500 | 0.002 ± 1.000 | 0.000 ± 0.500 | 0.2 <W        | 0.035 ± 1.000 | 0.03 ± 5.000 |
|               | H        | GL978447 | 1.14 ± 10.000 | 0.0005 <W    | 0.059 ± 0.500 | 0.011 ± 1.000 | 0.004 ± 0.500 | 0.2 <W        | 0.043 ± 1.000 | 0.02 ± 5.000 |
| Peninsula     | GL978412 | 19990720 | -0.71 ± 2.83  | 0.0005 <W    | 0.017 ± 0.05  | 0.009 ± 0.1   | 0.019 ± 0.05  | 0.2 <W        | 0.011 ± 0.1   | 0.05 ± 0.5   |
|               | F        | GL978412 | -1.52 ± 2.83  | 0.0005 <W    | 0.013 ± 0.05  | 0.014 ± 0.1   | 0.023 ± 0.05  | 0.2 <W        | 0.019 ± 0.1   | 0.12 ± 0.5   |
|               | H        | GL978412 | 0.00 ± 1      | 0.0005 <W    | 0.030 ± 0.05  | 0.000 ± 0.1   | 0.010 ± 0.05  | 0.2 <W        | 0.000 ± 0.1   | 0.20 ± 0.5   |
|               | F        | GL954012 | 0.00 ± 1      | 0.0005 <W    | 0.000 ± 0.05  | 0.000 ± 0.1   | 0.010 ± 0.06  | 0.2 <W        | 0.000 ± 0.1   | 0.20 ± 0.5   |
|               | T        | GL954012 | 0.00 ± 1      | 0.0005 <W    | 0.000 ± 0.05  | 0.000 ± 0.1   | 0.010 ± 0.06  | 0.2 <W        | 0.000 ± 0.1   | 0.20 ± 0.5   |
|               | H        | GL954012 | 0.00 ± 1      | 0.0005 <W    | 0.000 ± 0.05  | 0.000 ± 0.1   | 0.010 ± 0.06  | 0.2 <W        | 0.000 ± 0.1   | 0.20 ± 0.5   |
|               | F        | GL954012 | 0.00 ± 1      | 0.0005 <W    | 0.000 ± 0.05  | 0.000 ± 0.1   | 0.010 ± 0.06  | 0.2 <W        | 0.000 ± 0.1   | 0.20 ± 0.5   |
|               | H        | GL954012 | 0.00 ± 1      | 0.0005 <W    | 0.000 ± 0.05  | 0.000 ± 0.1   | 0.010 ± 0.06  | 0.2 <W        | 0.000 ± 0.1   | 0.20 ± 0.5   |
|               | F        | GL954012 | 0.00 ± 1      | 0.0005 <W    | 0.000 ± 0.05  | 0.000 ± 0.1   | 0.010 ± 0.06  | 0.2 <W        | 0.000 ± 0.1   | 0.20 ± 0.5   |
|               | H        | GL954012 | 0.00 ± 1      | 0.0005 <W    | 0.000 ± 0.05  | 0.000 ± 0.1   | 0.010 ± 0.06  | 0.2 <W        | 0.000 ± 0.1   | 0.20 ± 0.5   |
|               | F        | GL954012 | 0.00 ± 1      | 0.0005 <W    | 0.000 ± 0.05  | 0.000 ± 0.1   | 0.010 ± 0.06  | 0.2 <W        | 0.000 ± 0.1   | 0.20 ± 0.5   |

F: blank field blank

T: blank travel blank

H: Handling blank (Hg only)

Blank data for all organic compounds (PAHs, organochlorinated compounds, chlorinated benzenes etc.) were less than the method detection limit.



Appendix 2: Water quality data for field and travel blanks collected for the Lake Superior Harbour Water Quality Monitoring Survey, 1999

| Survey Area   | Field# | Date     | CUUT<br>u/L | FEUT<br>u/L     | HGUT<br>ng/L     | MNUT<br>u/L | MOUT<br>u/L     | NIUT<br>u/L      | NNHTUR<br>mg/L   | Valqual   | NNQ2UR<br>mg/L |
|---------------|--------|----------|-------------|-----------------|------------------|-------------|-----------------|------------------|------------------|-----------|----------------|
| Spanish River | F      | GL978424 | 1999/05/21  | -1.64 +/- 5.000 | 4.18 +/- 51.000  | 13.80       | 0.00 +/- 1.000  | 0.018 +/- 5.000  | -0.354 +/- 1.000 | 0.002 <EW | 0.001 <EW      |
|               | F      | GL978462 | 1999/05/21  | 0.26 +/- 5.000  | -5.53 +/- 50.000 | 7.50        | 0.27 +/- 1.000  | 0.018 +/- 5.000  | 0.040 +/- 1.000  | 0.002 <EW | 0.001 <EW      |
|               | T      | GL978463 | 1999/05/26  | -0.05 +/- 5.000 | -6.20 +/- 50.000 | 3.30        | 0.00 +/- 1.000  | 0.007 +/- 5.000  | -0.022 +/- 1.000 | 0.002 <EW | 0.001 <EW      |
|               | F      | GL977457 | 1999/04/11  | -0.20 +/- 0.5   | 2.00 +/- 5       |             | 0.10 +/- 0.1    | 0.000 +/- 0.5    | 0.000 +/- 0.1    | 0.002 <EW | 0.001 <EW      |
|               | T      | GL977458 | 1999/04/11  | -0.30 +/- 0.5   | 4.00 +/- 5       | 0.55        | 0.10 +/- 0.1    | 0.000 +/- 0.5    | 0.000 +/- 0.1    | 0.002 <EW | 0.001 <EW      |
| Nipigon Bay   | F      | GL954054 | 1999/10/20  | 0.20 +/- 0.5    | 1.00 +/- 5       | 2.10        | 0.10 +/- 0.1    | 0.000 +/- 0.5    | 0.000 +/- 0.1    | 0.002 <EW | 0.001 <EW      |
|               | T      | GL954055 | 1999/10/20  | 0.00 +/- 0.5    | 0.00 +/- 5       | 0.20 <T     | 0.00 +/- 0.1    | 0.000 +/- 0.5    | 0.000 +/- 0.1    | 0.002 <EW | 0.001 <EW      |
|               | H      | GL954056 | 1999/10/20  | -0.08 +/- 0.5   | 2.32 +/- 5       | 0.75        | 0.17 +/- 0.1    | 0.035 +/- 0.5    | 0.005 +/- 0.1    | 0.002 <EW | 0.001 <EW      |
|               | F      | GL978432 | 1999/05/22  | -0.19 +/- 0.5   | 0.80 +/- 5       | 5.00        | 0.01 +/- 0.1    | 0.000 +/- 0.5    | 0.000 +/- 0.1    | 0.002 <EW | 0.001 <EW      |
|               | T      | GL978433 | 1999/05/22  | 0.10 +/- 0.5    | -1.00 +/- 5      | 1.60        | 0.40 +/- 0.1    | 0.000 +/- 0.5    | 0.000 +/- 0.1    | 0.002 <EW | 0.001 <EW      |
| Jack-Max Bay  | F      | GL977421 | 1999/06/01  | 0.10 +/- 0.5    | -1.00 +/- 5      | 1.60        | 0.00 +/- 0.1    | 0.000 +/- 0.5    | 0.000 +/- 0.1    | 0.002 <EW | 0.001 <EW      |
|               | T      | GL977422 | 1999/06/01  | 0.10 +/- 0.5    | -1.00 +/- 5      | 1.60        | 0.00 +/- 0.1    | 0.000 +/- 0.5    | 0.000 +/- 0.1    | 0.002 <EW | 0.001 <EW      |
|               | H      | GL977423 | 1999/06/01  | 0.30 +/- 0.5    | 0.00 +/- 5       | 0.25        | 0.10 +/- 0.1    | 0.000 +/- 0.5    | 0.000 +/- 0.1    | 0.006 <T  | 0.001 <EW      |
|               | F      | GL954021 | 1999/10/11  | 0.10 +/- 0.5    | 2.00 +/- 5       | 1.50        | 0.00 +/- 0.1    | 0.000 +/- 0.5    | 0.000 +/- 0.1    | 0.004 <T  | 0.001 <EW      |
|               | T      | GL954022 | 1999/10/11  | 0.10 +/- 0.5    | 2.00 +/- 5       | 1.50        | 0.00 +/- 0.1    | 0.000 +/- 0.5    | 0.000 +/- 0.1    | 0.004 <T  | 0.001 <EW      |
| Poc River     | H      | GL954023 | 1999/10/11  | -0.31 +/- 5.000 | -7.27 +/- 50.000 | 2.80        | 0.10 +/- 1.000  | -0.015 +/- 5.000 | -0.057 +/- 1.000 | 0.002 <EW | 0.001 <EW      |
|               | F      | GL978407 | 1999/05/17  | -0.40 +/- 5.000 | -7.50 +/- 50.000 | 4.15        | -0.03 +/- 1.000 | -0.012 +/- 5.000 | -0.065 +/- 1.000 | 0.002 <EW | 0.001 <EW      |
|               | F      | GL977430 | 1999/06/02  | 0.50 +/- 0.5    | 3.00 +/- 5       | 0.60        | 0.80 +/- 0.1    | 0.000 +/- 0.5    | 0.000 +/- 0.1    | 0.002 <EW | 0.001 <EW      |
|               | T      | GL977431 | 1999/06/02  | 0.08 +/- 0.5    | 1.15 +/- 5       | 4.95        | 0.01 +/- 0.1    | 0.117 +/- 0.5    | 0.005 +/- 0.1    | 0.002 <EW | 0.001 <EW      |
|               | H      | GL977432 | 1999/06/02  | 0.30 +/- 0.5    | 1.00 +/- 5       | 0.65 <EW    | -0.20 +/- 0.2   | 0.000 +/- 0.5    | -0.009 +/- 0.6   | 0.004 <T  | 0.001 <EW      |
| Pinninsula    | F      | GL954030 | 1999/10/11  | -0.30 +/- 0.5   | 2.00 +/- 5       | 1.25        | -0.30 +/- 0.3   | 0.000 +/- 0.5    | -0.009 +/- 0.6   | 0.004 <T  | 0.001 <EW      |
|               | T      | GL954031 | 1999/10/11  | -0.30 +/- 0.5   | 2.00 +/- 5       | 1.25        | -0.30 +/- 0.3   | 0.000 +/- 0.5    | -0.009 +/- 0.6   | 0.004 <T  | 0.001 <EW      |
|               | H      | GL977445 | 1999/05/19  | -0.74 +/- 5.000 | 3.24 +/- 50.000  | 7.75        | 0.04 +/- 1.000  | 0.013 +/- 5.000  | -0.133 +/- 1.000 | 0.002 <EW | 0.001 <EW      |
|               | F      | GL977446 | 1999/05/19  | -0.84 +/- 5.000 | 2.16 +/- 50.000  | 2.50        | 0.02 +/- 1.000  | 0.013 +/- 5.000  | -0.130 +/- 1.000 | 0.002 <EW | 0.001 <EW      |
|               | T      | GL977447 | 1999/05/19  | -0.84 +/- 5.000 | 2.16 +/- 50.000  | 2.50        | 0.02 +/- 1.000  | 0.013 +/- 5.000  | -0.130 +/- 1.000 | 0.002 <EW | 0.001 <EW      |
| Thunder Bay   | F      | GL977448 | 1999/05/26  | 0.04 +/- 0.5    | 2.63 +/- 5       | 1.60        | 0.04 +/- 0.1    | 0.101 +/- 0.5    | -0.014 +/- 0.1   | 0.002 <EW | 0.001 <EW      |
|               | T      | GL977449 | 1999/05/26  | 0.04 +/- 0.5    | 2.63 +/- 5       | 1.60        | 0.04 +/- 0.1    | 0.101 +/- 0.5    | -0.014 +/- 0.1   | 0.002 <EW | 0.001 <EW      |
|               | H      | GL977450 | 1999/05/26  | 0.20 +/- 0.5    | 1.98 +/- 5       | 0.85        | 0.14 +/- 0.1    | 0.093 +/- 0.5    | 0.029 +/- 0.1    | 0.002 <EW | 0.001 <EW      |
|               | F      | GL977451 | 1999/05/26  | -0.03 +/- 0.5   | 1.00 +/- 5       | 0.15 <T     | 0.06 +/- 0.1    | 0.067 +/- 0.5    | -0.016 +/- 0.1   | 0.002 <EW | 0.001 <EW      |
|               | T      | GL977452 | 1999/05/26  | -0.03 +/- 0.5   | 1.00 +/- 5       | 0.15 <T     | 0.06 +/- 0.1    | 0.067 +/- 0.5    | -0.016 +/- 0.1   | 0.002 <EW | 0.001 <EW      |
| Thunder Bay   | F      | GL954046 | 1999/10/15  | 0.10 +/- 0.5    | 3.00 +/- 7       | 0.05 <EW    | 0.00 +/- 0.1    | 0.000 +/- 0.5    | 0.000 +/- 0.1    | 0.004 <T  | 0.001 <EW      |
|               | T      | GL978446 | 1999/05/26  | 0.18 +/- 5.000  | 0.41 +/- 50.000  | 9.05        | 0.12 +/- 1.000  | 0.018 +/- 5.000  | 0.041 +/- 1.000  | 0.004 <T  | 0.001 <EW      |
|               | F      | GL978447 | 1999/05/26  | 0.18 +/- 5.000  | 0.41 +/- 50.000  | 9.05        | 0.12 +/- 1.000  | 0.018 +/- 5.000  | 0.041 +/- 1.000  | 0.004 <T  | 0.001 <EW      |
|               | H      | GL978448 | 1999/05/26  | 0.45 +/- 0.5    | 0.43 +/- 5       | 0.90        | 0.04 +/- 0.1    | 0.091 +/- 0.5    | 0.014 +/- 0.1    | 0.002 <EW | 0.001 <EW      |
|               | T      | GL977412 | 1999/07/29  | 0.45 +/- 0.5    | 0.43 +/- 5       | 0.90        | 0.04 +/- 0.1    | 0.091 +/- 0.5    | 0.014 +/- 0.1    | 0.002 <EW | 0.001 <EW      |
| Thunder Bay   | F      | GL977413 | 1999/07/29  | 0.45 +/- 0.5    | 0.43 +/- 5       | 0.90        | 0.04 +/- 0.1    | 0.091 +/- 0.5    | 0.014 +/- 0.1    | 0.002 <EW | 0.001 <EW      |
|               | T      | GL977414 | 1999/07/29  | 0.45 +/- 0.5    | 0.43 +/- 5       | 0.90        | 0.04 +/- 0.1    | 0.091 +/- 0.5    | 0.014 +/- 0.1    | 0.002 <EW | 0.001 <EW      |
|               | H      | GL977415 | 1999/07/29  | 0.45 +/- 0.5    | 0.43 +/- 5       | 0.90        | 0.04 +/- 0.1    | 0.091 +/- 0.5    | 0.014 +/- 0.1    | 0.002 <EW | 0.001 <EW      |
|               | F      | GL954012 | 1999/10/10  | 0.10 +/- 0.5    | 2.00 +/- 5       | 1.15        | 0.10 +/- 0.1    | -0.100 +/- 0.5   | 0.100 +/- 0.1    | 0.004 <T  | 0.001 <EW      |
|               | T      | GL954013 | 1999/10/10  | 0.10 +/- 0.5    | 2.00 +/- 5       | 0.40        | 0.10 +/- 0.1    | -0.100 +/- 0.5   | 0.100 +/- 0.1    | 0.004 <T  | 0.001 <EW      |
| Thunder Bay   | F      | GL954014 | 1999/10/10  | 0.15 <T         | 0.15 <T          | 0.15 <T     | 0.15 <T         | 0.15 <T          | 0.15 <T          | 0.004 <T  | 0.001 <EW      |
|               | T      | GL954014 | 1999/10/10  | 0.15 <T         | 0.15 <T          | 0.15 <T     | 0.15 <T         | 0.15 <T          | 0.15 <T          | 0.004 <T  | 0.001 <EW      |

F-blank field blank

T-blank travel blank

H-handling blank (Hg only)

Blank data for all organic compounds (PAHs, organochlorines)



Appendix 2 Water quality data for field and travel blanks collected for the Lake Superior Harbour Water Quality Monitoring Survey, 1999

| Survey Area   | Field#      | Date     | NNOTUR<br>mg/L | NNIKUR<br>mg/L | PRUT<br>ug/L    | Volqual | PPUT<br>mg/L | RSP<br>mg/L | SRUT<br>ug/L    | TIUT<br>ug/L    | VTUT<br>ug/L    | ZNUT<br>ug/L    | Volqual |
|---------------|-------------|----------|----------------|----------------|-----------------|---------|--------------|-------------|-----------------|-----------------|-----------------|-----------------|---------|
| Spanada River | F GL1978474 | 19990521 | 0.015 <T       | 0.02 <W        | -0.13 +/- 0.500 |         | 0.002 <W     | 0.5 <W      | 0.40 +/- 1.000  | 0.27 +/- 2.000  | 0.01 +/- 1.000  | 0.32 +/- 2.000  |         |
|               | F GL1978472 | 19990521 | 0.005 <W       | 0.08 <T        | 0.00 +/- 0.500  |         | 0.006 <T     | 0.5 <T      | 0.06 +/- 1.000  | 0.22 +/- 2.000  | 0.01 +/- 1.000  | 1.82 +/- 2.000  |         |
|               | F GL1978463 | 19990504 | 0.005 <W       | 0.02 <W        | -0.01 +/- 0.500 |         | 0.002 <W     | 0.5 <W      | 0.05 +/- 1.000  | 0.08 +/- 2.000  | 0.01 +/- 1.000  | 0.78 +/- 2.000  |         |
|               | F GL1977457 | 19990811 | 0.005 <W       | 0.02 <W        | 0.02 +/- 0.05   |         | 0.002 <W     | 0.5 <W      | 0.10 +/- 0.2    | 0.10 +/- 0.2    | 0.01 +/- 0.05   | 0.02 +/- 0.3    |         |
|               | F GL1977458 | 19990811 | 0.005 <W       | 0.02 <W        | 0.01 +/- 0.05   |         | 0.002 <W     | 0.5 <W      | 0.03 +/- 0.2    | 0.08 +/- 0.2    | -0.01 +/- 0.05  | 1.00 +/- 0.2    |         |
| Nipigon Bay   | F GL1954054 | 19990320 | 0.030          | 0.04 <T        | 0.03 +/- 0.05   |         | 0.002 <W     | 0.5 <W      | 0.10 +/- 0.2    | 0.10 +/- 0.2    | 0.04 +/- 0.05   | 0.04 +/- 0.2    |         |
|               | F GL1954055 | 19990320 | 0.020          | 0.04 <T        | 0.01 +/- 0.05   |         | 0.004 <T     | 0.5 <W      | -0.10 +/- 0.2   | 0.20 +/- 0.2    | -0.01 +/- 0.05  | 0.30 +/- 0.3    |         |
|               | F GL1978412 | 19990522 | 0.010 <T       | 0.24           | 0.01 +/- 0.05   |         | 0.010        | 0.5 <W      | 0.32 +/- 0.20   | 0.08 +/- 0.20   | 0.02 +/- 0.05   | 0.08 +/- 0.2    |         |
|               | F GL1978413 | 19990522 | 0.025 <W       | 0.02 <W        | 0.01 +/- 0.05   |         | 0.002 <W     | 0.5 <W      | 0.05 +/- 0.171  | 0.02 +/- 0.2    | 0.00 +/- 0.05   | 0.13 +/- 0.209  |         |
|               | F GL1977423 | 19990801 | 0.025 <W       | 0.02 <W        | 0.02 +/- 0.05   |         | 0.002 <W     | 0.5 <W      | 0.10 +/- 0.1    | 0.20 +/- 0.2    | 0.04 +/- 0.05   | 1.60 +/- 0.4    |         |
| Jackson Bay   | H GL1977423 | 19990801 | 0.005 <W       | 0.02 <W        | 1.08 +/- 0.12   |         | 0.002 <W     | 0.5 <W      | 0.00 +/- 0.1    | 0.10 +/- 0.2    | 0.01 +/- 0.05   | 1.70 +/- 0.3    |         |
|               | F GL1954021 | 19990101 | 0.018 <T       | 0.02 <W        | -0.02 +/- 0.05  |         | 0.008 <T     | 0.5 <W      | 0.20 +/- 0.3    | 0.00 +/- 0.3    | 0.02 +/- 0.05   | 2.40 +/- 0.2    |         |
|               | T GL1954022 | 19990101 | 0.014 <T       | 0.02 <W        | -0.02 +/- 0.05  |         | 0.002 <W     | 0.5 <W      | 0.00 +/- 0.3    | 0.00 +/- 0.4    | 0.02 +/- 0.05   | 0.20 +/- 0.2    |         |
|               | H GL1954023 | 19990101 | 0.010 <T       | 0.02 <W        | -0.01 +/- 0.500 |         | 0.002 <W     | 0.5 <W      | 2.12 +/- 1.100  | 0.17 +/- 2.000  | 0.01 +/- 1.000  | 2.18 +/- 2.000  |         |
|               | F GL1978408 | 19990518 | 0.010 <T       | 0.02 <W        | -0.04 +/- 0.500 |         | 0.002 <W     | 0.5 <W      | -0.08 +/- 1.000 | 0.00 +/- 2.000  | 0.00 +/- 1.000  | -0.08 +/- 2.000 |         |
| Pic River     | T GL1977430 | 19990802 | 0.020 <T       | 0.02 <W        | 0.02 +/- 0.05   |         | 0.002 <W     | 0.5 <W      | 0.10 +/- 0.1    | 0.10 +/- 0.2    | 0.05 +/- 0.05   | 2.50 +/- 0.8    |         |
|               | T GL1977431 | 19990802 | 0.020 <T       | 0.02 <W        | 0.01 +/- 0.05   |         | 0.002 <W     | 0.5 <W      | -0.04 +/- 0.132 | 0.03 +/- 0.146  | -0.05 +/- 0.1   | 0.84 +/- 0.146  |         |
|               | H GL1977412 | 19990802 | 0.048          | 0.02 <W        | -0.02 +/- 0.05  |         | 0.002 <W     | 0.5 <W      | -0.10 +/- 0.3   | 0.00 +/- 0.2    | 0.02 +/- 0.05   | 0.80 +/- 0.2    |         |
|               | F GL1954010 | 19990103 | 0.013 <T       | 0.02 <W        | 0.00 +/- 0.05   |         | 0.002 <W     | 0.5 <W      | -0.10 +/- 0.3   | 0.00 +/- 0.2    | 0.01 +/- 0.05   | -0.10 +/- 0.3   |         |
|               | H GL1954032 | 19990103 | 0.020 <T       | 0.02 <W        | -0.04 +/- 0.500 |         | 0.002 <W     | 0.5 <W      | 0.40 +/- 1.000  | 0.02 +/- 2.000  | 0.02 +/- 1.000  | 0.21 +/- 2.000  |         |
| Permaine      | F GL1978415 | 19990519 | 0.010 <T       | 0.02 <W        | -0.04 +/- 0.500 |         | 0.002 <W     | 0.5 <W      | 0.12 +/- 1.000  | 0.00 +/- 2.000  | 0.01 +/- 1.000  | 1.04 +/- 2.000  |         |
|               | T GL1978416 | 19990519 | 0.005 <W       | 0.02 <W        | 0.01 +/- 0.505  |         | 0.002 <W     | 0.5 <W      | -0.07 +/- 0.202 | 0.17 +/- 0.327  | -0.03 +/- 0.1   | 1.75 +/- 0.307  |         |
|               | T GL1977448 | 19990805 | 0.005 <W       | 0.02 <W        | 0.03 +/- 0.05   |         | 0.004 <T     | 0.5 <W      | 0.17 +/- 0.130  | 0.08 +/- 0.145  | -0.04 +/- 0.1   | 2.25 +/- 0.565  |         |
|               | H GL1977449 | 19990805 | 0.005 <W       | 0.02 <W        | -0.01 +/- 0.05  |         | 0.004 <T     | 0.5 <W      | -0.07 +/- 0.143 | 0.04 +/- 0.193  | -0.04 +/- 0.1   | 0.58 +/- 0.206  |         |
|               | F GL1977440 | 19990804 | 0.005 <W       | 0.02 <W        | 0.00 +/- 0.05   |         | 0.006 <T     | 0.5 <W      | 0.00 +/- 0.2    | -0.10 +/- 0.3   | 0.00 +/- 0.05   | 1.80 +/- 0.4    |         |
| Thunder Bay   | T GL1977442 | 19990804 | 0.031          | 0.02 <W        | 0.00 +/- 0.05   |         | 0.002 <W     | 0.5 <W      | 0.27 +/- 1.000  | 0.02 +/- 2.000  | -0.02 +/- 1.000 | 2.07 +/- 2.100  |         |
|               | F GL1954046 | 19990715 | 0.020 <T       | 0.02 <W        | 0.01 +/- 0.500  |         | 0.002 <W     | 0.5 <W      | 0.01 +/- 1.000  | -0.08 +/- 2.000 | -0.04 +/- 1.000 | 1.18 +/- 2.100  |         |
|               | T GL1978446 | 19990528 | 0.010 <T       | 0.02 <W        | 0.14 +/- 0.510  |         | 0.002 <W     | 0.5 <W      | 0.01 +/- 1.000  | 0.32 +/- 0.336  | 0.04 +/- 0.1    | 1.27 +/- 0.162  |         |
|               | H GL1978449 | 19990528 | 0.005 <W       | 0.02 <W        | 0.08 +/- 0.05   |         | 0.002 <W     | 0.5 <W      | 0.13 +/- 0.12   | 0.14 +/- 0.2    | -0.04 +/- 0.1   | 0.02 +/- 0.360  |         |
|               | F GL1977413 | 19990728 | 0.005 <W       | 0.02 <W        | 0.01 +/- 0.05   |         | 0.002 <W     | 0.5 <W      | 0.01 +/- 0.13   | 0.09 +/- 0.2    | 0.01 +/- 0.05   | 1.00 +/- 0.2    |         |
| Blank         | F GL1954012 | 19990105 | 0.032 <T       | 0.02 <W        | 0.02 +/- 0.05   |         | 0.002 <W     | 0.5 <W      | 0.10 +/- 0.2    | -0.10 +/- 0.2   | -0.03 +/- 0.05  | 1.40 +/- 0.2    |         |
|               | T GL1954013 | 19990105 | 0.015 <T       | 0.02 <W        | 0.00 +/- 0.00   |         | 0.002 <W     | 0.5 <W      | 0.00 +/- 0.2    |                 |                 |                 |         |
|               | H GL1954014 | 19990105 |                |                |                 |         |              |             |                 |                 |                 |                 |         |

F: blank field blank

T: blank travel blank

H: Handling blank (Hg only)

Blank data for all organic compounds (PAHs, organochlorine)







